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WEST COAST
OF
HINDUSTAN PILOT.
FOURTH EDITION.

1898.

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British Admiralty.

THE

WEST COAST OF HINDUSTAN PILOT

INCLUDING

THE GULF OF MANAR, THE MALDIVE AND LACCADIVE ISLANDS.

ORIGINALLY COMPILED

By Commander A. D. TAYLOR, late Indian Navy.

FOURTH EDITION.

Wharton, R. N. A.

PUBLISHED BY ORDER OF THE LORDS COMMISSIONERS OF THE ADMIRALTY.

LONDON:
PRINTED FOR THE HYDROGRAPHIC OFFICE, ADMIRALTY,
By EYRE and SPOTTISWOODE, East Harding Street, Fleet Street, E.C.;
AND SOLD BY
J. D. POTTER, Agent for the Sale of Admiralty Charts,
31, POULTRY, and 11, KING STREET, TOWER HILL.

1898.

Price Four Shillings.

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ADVERTISEMENT TO THE FOURTH EDITION.

The West Coast of Hindustan Pilot contains Sailing Directions for the coasts of Sind, Kutch, and Kathiawar; the gulf of Cambay; and the west coast of Hindustan, commonly spoken of as the Malabar coast; also for the west coast of Ceylon which is included in the gulf of Manar, and for the Maldive and Laccadive islands. This work was originally compiled in 1866 by Commander A. D. Taylor, late I.N., from the following sources:—

The gulf of Manar, from the printed remarks of Messrs. Twynam, and Franklin, R.N., and from Sir Emerson Tennant's well-known work on Ceylon. The west coast of Hindustan, from Cape Comorin to Karachi, from manuscript remarks by officers of the late Indian Navy:—southward of Bombay by Commanders A. D. Taylor and R. Williams; gulf of Cambay by Captains R. Ethersey and C. G. Constable; Kathiawar, Kutch, and Sind by Commanders A. M. Grieve and A. D. Taylor, and Mr. W. A. Fenner. Use was also made of Horsburgh's East India Directory, and Thornton's Gazetteer. The Maldives, from the writings of the surveying officers under Captain R. Moresby published in the Bombay Geographical Society's Journal.

A second edition was published in 1880 and a third in 1891.

In the present edition, prepared by Captain John Phillips, R.N., the most recent information resulting from the latest Surveys of the Indian Government, from the Remark Books of Officers of Her Majesty's Ships, and other documents in the Hydrographical Department, has been incorporated.

The barometric pressure, and the description of the winds and currents in the Arabian sea and North Indian ocean are chiefly from a memoir by Mr. W. L. Dallas, published at Calcutta, 1887. The barometric, wind and current charts, published by the Meteorological Department of the Government of India, 1888; and the Admiralty wind and current charts have also been consulted. In this work, the names of places on the west coast of Hindustan, are chiefly from the Imperial Gazetteer of India, by W. W. Hunter, C.I.E., LL.D.; and those of the Maldive islands are on the authority of H. C. P. Bell, Esq., Ceylon Civil Service.

Officers of the Royal Navy and Mercantile Marine are requested to transmit to the Secretary of the Admiralty any notices of errors or omissions they may discover, as well as any fresh information they may obtain, in order that this work may be improved for the general benefit of the navigator.

By the publication of this work, all Hydrographic Notices relating to former editions and all Notices to Mariners, inclusive of No. 447 of 1898, are cancelled.

W. J. L. W.

Hydrographic Office, Admiralty, London,
December 1898.

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SYSTEM OF ORTHOGRAPHY.

Adopted by the Admiralty for Sailing Directions and Charts.

As far as has been found possible with existing knowledge, native names are spelt in accordance with the following system, which has been adopted by the principal authorities in Great Britain and by the United States, and has been for some years in process of gradual introduction into all Admiralty Sailing Directions and Charts.

No change is made in the orthography of foreign names in countries which use Roman letters; thus French, Spanish, Portuguese, Dutch, &c. names will be spelt as by the respective nations.

1. Where native names have been so long written in a form, which, though not in accordance with this system, has become familiar to English eyes from being so spelt in all charts and maps, they are retained.

2. The true sound of the word, as locally pronounced, is taken as the basis of the spelling.

3. An approximation of the sound is alone aimed at. A system which would attempt to represent the more delicate inflections of sound and accent would be so complicated as only to defeat itself.

4. The broad features of the system adopted are that vowels are pronounced as in Italian and consonants as in English; *every letter being pronounced.* Two accents only are used:—

(1.) The acute, to denote the syllable on which stress is laid. The use of this is very important, as the sounds of many names are entirely altered by the misplacement of this "stress."

(2.) The sign ˘ over the letter U to denote the short sound of that vowel under certain circumstances. (See table.)

5. When two vowels come together, each one is sounded, though the result, when spoken quickly, is sometimes scarcely to be distinguished from a single sound, as in *ai*, *au*, *ei*.

The amplification of the rules is given on the following pages.

Information is invited as to the proper spelling of native names, so as to produce the nearest approximation to the true sound, by this system.

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Letters.	Pronunciation and Remarks.	Examples.
a	*ah*, *a* as in *father* - - -	Java, Banána, Somáli, Bari.
e	*eh*, *e* as in *benefit*; *a* as in fate - -	Tel-el-Kebír, Oléleh, Yezo, Levúka, Peru.
i	English *e*; *i* as in *ravine*; the sound of *ee* in *beet*. Thus, not *Feejee*, but	Fiji, Hindi.
o	*o* as in mote - - - -	Tokyo.
u	long *u* as in *flute*; the sound of *oo* in *boot*. *oo* or *ou* should never be employed for this sound. Thus, not *Zooloo* or *Zoulou*, but - - - -	Zulu, Sumatra.
	The shorter sound of the different vowels, when necessary to be indicated, can be expressed by doubling the consonant that follows. The sounds referred to are as follows :— The short *a* as in *fatter*, as compared with the long *a* as in *father*. The short *e* as in *better*, as compared with the long *e* as in *fate*. The short *i* as in *sinner*, as compared with the long *i* as in *ravine*. The short *o* as in *sobbing*, as compared with the long *o* as in *sober*. The short *u* as in *rubber*, as compared with the long *u* as in *rubric*.	Yarra, Tanna, Mecca, Jidda, Bonny.*
ŭ	is the same short sound of *u* as is denoted by doubling the consonant following, but is used, and only used, where such doubling is impossible, as in case of words where *u* is followed by two different consonants, as in Tŭng, pronounced as the English *tongue*.	
	Doubling of a vowel is only necessary where there is a distinct repetition of the single sound.	Nuulúa, Oosima.
ai	English *i* as in *ice* - - -	Shanghai.
au	*ow* as in *how* - thus, not *Foochow*, but	Fuchau.
ao	is slightly different from *au* - -	Macao.
aw	when followed by a consonant or at the end of a word, as in *law* - thus	Cawnpore.

* The *y* is retained as a terminal in this word under rule 1. The word is given as a familiar example of the alteration in sound caused by the second consonant.

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Letters.	Pronunciation and Remarks.	Examples.
ei	is the sound of the two Italian vowels, but is frequently slurred over, when it is scarcely to be distinguished from *ey* in the English *they*, or *ei* in *eight*.	Beirút, Beilul.
b	English *b*.	
c	is always soft, but is so nearly the sound of *s* that it should be seldom used. If *Celébes* were not already recognised it would be written *Selébes*.	Celébes.
ch	is always soft, as in *church* - -	Chingchin.
d	English *d*.	
f	English *f*. *Ph* should not be used for the sound of *f*. Thus, not *Haiphong*, but	Haifong, Nafa.
g	is always hard. (Soft *g* is given by *j*) -	Galápagos.
h	is always pronounced when used.	
hw	as in *what*, better rendered by *hw* than *wh*, or *h* followed by a vowel. Thus, *Hwang ho*, not *Whang ho* or *Hoang ho*.	Hwang ho, Ngan hwei.
j	English *j*. *Dj* should never be put for this sound.	Japan, Jinchuen.
k	English *k*. It should always be put for the hard *c*. Thus, not *Corea*, but -	Korea.
kh	The Oriental guttural - - -	Khan.
gh	is another guttural, as in the Turkish -	Dagh, Ghazi.
l m n	As in English.	
ng	has two separate sounds, the one hard as in the English word *finger*, the other as in *singer*. As these two sounds are rarely employed in the same locality, no attempt is made to distinguish between them.	
p	As in English.	
ph	As in *loophole* - - - -	Mokpho, Chemulpho.
th	Stands both for its sound in *thing*, and as in *this*. The former is most common.	Bethlehem.
q	should never be employed; the sound of *qu* in *quiver* is given as *kw*. When *qu* has the sound of *k*, as in *quoit*, it should be given by *k*.	Kwangtung.

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Letters.	Pronunciation and Remarks.	Examples.
r	As in English.	
s	As in *sin*.	
sh t v w x	As in English. - - - - - -	Sawákin.
y	is always a consonant, as in *yard*, and therefore should never be used as a terminal, *i* or *e* being substituted. Thus not *Mikindány* or *Wady*, but not *Kwaly*, but	Kikūyu. Mikindáni, Wadi. Kwale.
z	English *z* - - - -	Zulu.
zh	French *j*, or as *s* in treasure - -	Muzhdaha.
	Accents should not generally be used, but where there is a very decided emphatic syllable or stress which affects the sound of the word, it should be marked by an *acute* accent - -	Tongatábu, Galápagos, Paláwan, Saráwak.

In the case of native names in countries under the dominion of other European powers, in whose maps, charts, &c., the spelling is given according to the system adopted by that power, such orthography is, as a rule, disregarded, and the names are spelt according to the British system. Thus the island east of Java in possession of the Dutch is spelt Madoera by them, but on Admiralty charts Madura. A town in Java appears on Dutch charts as Tjilatjap; in the British, Chilachap.

When a foreign language is written in a vocabulary of fixed sounds, so as to permit of transliteration into the British system, a table of equivalents for each letter is drawn up, and names of places can be transliterated without regard to pronunciation.

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MARINER'S COMPASS.

Hindustáni.	English.	Hindustáni.	English.
Gí - - -	North.	Súli - - -	South.
Gí wíjau choki - -	N. by E.	Súli wíjau choki -	S. by W.
Gí wíjau tír - -	N.N.E.	Súli wíjau tír -	S.S.W.
Gí wíjau tír wíjau choki -	N.E. by N.	Súli wíjau arkrop dau choki.	S.W. by S.
Gí wíjau arkrop - -	N.E.	Súli wíjau arkrop -	S.W.
Gí wíjau arkrop wíjau choki	N.E. by E.	Súli wíjau arkrop wíjau choki.	S.W. by W.
Mutli dau tír - -	E.N.E.	Kabli dau tír - -	W.S.W.
Mutli dau choki - -	E. by N.	Kabli dau chokí - -	W. by S.
Mutli - - -	East.	Kabli - - -	West.
Mutli wíjau choki -	E. by S.	Kabli wíjau choki -	W. by N.
Mutli wíjau tír - -	E.S.E.	Kabli wíjau tír - -	W.N.W.
Súli dau arkrop dau choki	S.E. by E.	Gí dau arkrop dau choki	N.W. by W.
Súli dau arkrop - -	S.E.	Gí dau arkrop - -	N.W.
Súli dau arkrop wíjau choki	S.E. by S.	Gí dau tír dau choki -	N.W. by N.
Súli dau tír - -	S.S.E.	Gí dau tír - -	N.N.W.
Súli dau choki - -	S. by E.	Gí dau choki - -	N. by W.

GLOSSARY

OF A FEW WORDS USED IN CHARTS AND SAILING DIRECTIONS.

Hindustáni.	Arabic.	English.
Balu Danda - - -	Kinasat. Najwa -	Shoal or sandbank.
	Bandar - - -	Landing place, sheltered anchorage.
Bara Gam - - -	Balad - - -	Town.
Chota Gam - - -	Do. - - -	Village.
Giri; pahar (par) - -	Jebel - - -	Mountain or hill.
Jinjira; dip; lanka -	Jezírat - - -	Island.
Kari - - - -	- - - -	River.
Karu - - -	Ras - - -	Point.
Nadi; nulla - - -	Khor - - -	Creek.

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INFORMATION RELATING TO CHARTS, SAILING DIRECTIONS, AND THE GENERAL NAVIGATION OF H.M. SHIPS.

ON THE CORRECTION OF CHARTS, LIGHT LISTS, AND SAILING DIRECTIONS.

There are three descriptions of publications as guides to navigation—the charts, the sailing directions, and the light lists—which are all affected by the continual changes and alterations that take place.

Of these, the charts should always be, so far as our knowledge permits, absolutely correct to date; and the light lists should be noted for the recent alterations, though space will not permit of full details being always inserted; the sailing directions, however, cannot, from their nature, be so corrected, and *in all cases where they differ from charts, the charts must be taken as the guide.*

1. *Charts.*—When issued to a ship on commissioning, the charts have received all necessary corrections to date. As sent from the Hydrographic Office they are, as a rule, fresh from the plates. They then receive such corrections by hand in the depôts as are required, and are so issued to the ships.

All small but important corrections that can be made by hand are notified by Notices to Mariners, and should at once be placed on the charts to which they refer.

Large corrections that cannot be conveniently thus made, are put upon the plates, and fresh copies are issued to the ships to replace the others, which are directed to be destroyed to prevent the possibility of their being used in the navigation of the ship.

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The dates on which these large corrections are made are noted on the chart plates in the middle of the lower edge, those of the smaller corrections at the left-hand lower corners.

In all cases of quotations of charts, these dates of corrections should be given, as well as the number of the chart (which will be found in the lower right-hand corner), in order that at the Admiralty it may be known what edition of the chart is referred to.

2. *The Light Lists*, annually published at the beginning of each year, are not corrected in the depôts before issue, but appendices are issued every two months, giving the alterations that have taken place, copies of which are put into the chart boxes.

It is the duty of the navigating officer when he receives the set of charts, to make notations in the light lists from these appendices, and from the Notices to Mariners in the box; and to keep them so corrected from time to time.

The Light Lists should always be consulted as to the details of a light, as the descriptions in the Sailing Directions may be obsolete, in consequence of changes made since publication.

3. *The Sailing Directions* are not corrected before issue, except occasionally for very important new rocks or dangers. Hydrographic Notices and Supplements referring to each volume, are published from time to time.

Supplements contain all the information received up to date since the publication of the volume to which they refer, and cancel all previous Hydrographic Notices.

Hydrographic Notices contain all information up to date since the publication of the volume, or since the last Supplement or Hydrographic Notice, but endeavour is made to issue no more than one of these affecting each volume, and, on the collection of fresh information, to include the former Notice in a Supplement.

The existence of Supplement or Hydrographic Notices is to be noted, in the tabulated form placed for the purpose inside the cover of each volume, in cases when such notations have not been made before issue, and also on receipt of further Notices after commission.

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Notes should be made in the margin of the volume of sailing directions affected, as references to the Supplements or Hydrographic Notices when the latter are printed on both sides.

To enable the books to be more conveniently corrected, however, such Supplements and Hydrographic Notices as are of moderate size are now being printed on one side only, and two copies are issued to each ship; one to cut up, the slips being pasted in at the appropriate place; the other to retain intact for reference.

To make these notations or paste in these slips, is one of the early duties of a navigating officer after drawing his box of charts and books, and similar notes are to be made from Notices to Mariners that may thereafter be received.

It must, however, be thoroughly understood that sailing directions will never be correct in all details, except up to the date of the last Hydrographic Notice or Supplement, and that, as already stated, when differences exist, the chart, which should be corrected from the most recent information, should be taken as the guide; for which purpose, for ordinary navigation, they are sufficient.

THE USE OF CHARTS AS NAVIGATIONAL AIDS, AND GENERAL REMARKS RELATING TO PRACTICAL NAVIGATION.

1. *Accuracy of a Chart.*—The value of a chart must manifestly depend upon the accuracy of the survey on which it is based, and this becomes more important the larger is the scale of the chart.

To estimate this, the date of the survey, which is always given in the title, is a good guide. Besides the changes that, in waters where sand or mud prevails, may have taken place since the date of the survey, the earlier surveys were mostly made under circumstances that precluded great accuracy of detail, and until a plan founded on such a survey is tested, it should be regarded with caution. It may, indeed, be said that, except in well-frequented harbours and their approaches, no surveys yet made have been so minute in their examination of the bottom as to make it certain that all dangers have been found. The fulness or scantiness of the

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soundings is another method of estimating the completeness of a chart. When the soundings are sparse or unevenly distributed, it may be taken for granted that the survey was not in great detail.

Blank spaces among soundings mean that no soundings have been obtained in these spots. When the surrounding soundings are deep, it may with fairness be assumed that in the blanks, the water is also deep; but when they are shallow, or it can be seen from the rest of the chart that reefs or banks are present, such blanks should be regarded with suspicion. This is especially the case in coral regions and off rocky coasts, and it should be remembered that in waters where rocks abound it is always possible that a survey, however complete and detailed, may have failed to find every small patch.

A wide berth should therefore be given to every rocky shore or patch, **and this rule should be invariably followed, viz., that instead of considering a coast to be clear unless it is shown to be foul, the contrary should be assumed.**

2. *Fathom Lines a Caution.*—Except in plans of harbours that have been surveyed in detail, the five-fathom line on most Admiralty charts is to be considered as a caution or danger line against unnecessarily approaching the shore or bank within that line, on account of the possibility of the existence of undiscovered inequalities of the bottom, which nothing but an elaborate detailed survey could reveal. In general surveys of coasts or of little frequented anchorages, the necessities of navigation do not demand the great expenditure of time required for such a detailed survey. It is not contemplated that ships will approach the shores in such localities without taking special precautions.

The ten-fathom line is, on rocky shores, another warning, especially for ships of heavy draught.

Charts where no fathom lines are marked, must be especially regarded with caution, as it generally means that soundings were too scanty and the bottom too uneven to enable them to be drawn with accuracy.

Isolated soundings, shoaler than surrounding depths, should always be avoided, especially if ringed round, as there is no knowing how closely the spot may have been examined.

3. *Chart on largest scale always to be used.*—It sometimes happens that, from press of work, only the copper plate of the larger scale chart of a particular locality can at once receive any extensive re-arrangement of

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coastline or soundings. This is an additional reason, besides the obvious one of the greater detail shown on a larger scale chart, why this largest scale chart should always be used for navigating.

4. *Caution in using small scale Charts.*—In approaching the land or dangerous banks, regard must always be had to the scale of the chart used. A small error in laying down a position means only yards on a large scale chart, whereas on a small scale the same amount of displacement means large fractions of a mile. This is particularly to be observed when coming to an anchor on a narrow ledge of convenient depth at some distance from the shore.

For the same reason, bearings to objects near should be used in preference to objects farther off, although the latter may be more prominent, as a small error in bearing or in laying it down on the chart has a greater effect in misplacing the position the longer the line to be drawn.

5. *Distortion of Printed Charts.*—The paper on which charts are printed has to be damped. On drying, distortion takes place, from the inequalities in the paper, which greatly varies with different paper and the amount of the original damping; but it does not affect navigation. It must not, however, be expected that accurate series of angles taken to different points will always exactly agree, when carefully plotted upon the chart, especially if the lines to objects be long. The larger the chart the greater the amount of this distortion.

6. *Buoys.*—It is manifestly impossible that any reliance can be placed on buoys always maintaining their exact position. Buoys should therefore be regarded as warnings and not as infallible navigating marks, especially when in exposed positions; and a ship should always, when possible, be navigated by bearings or angles of fixed objects on shore and not by buoys.

Gas Buoys.—The lights shown by gas buoys cannot be implicitly relied on, as, if occulting, the apparatus may get out of order, or the light may be altogether extinguished.

7. *Lights.*—Circles drawn on charts round a light are not intended to give information as to the distance at which it can be seen, but solely indicate, in the case of lights which do not show equally in all directions, the bearings between which the variation, or visibility, or obscuration of the light occurs.

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All the distances given in the Light Lists and on the charts for the visibility of lights are calculated for a height of an observer's eye of 15 feet. The table of distances visible due to height at end of each Light List, affords a means of ascertaining how much more or less the light is visible should the height of the bridge be more or less. The glare of a powerful light is often seen far beyond the limit of visibility of the actual rays of the light, but this must not be confounded with the true range. Again, refraction may often cause a light to be seen farther than under ordinary circumstances.

When looking out for a light at night, the fact is often forgotten that from aloft the range of vision is much increased. By noting a star immediately over the light, a very correct bearing may be afterwards obtained from the standard compass.

The intrinsic power of a light should always be considered when expecting to make it in thick weather. A weak light is easily obscured by haze, and no dependence can be placed on its being seen.

The power of a light can be estimated by remarking its order, as given in the Light Lists, and in some cases by noting how much its visibility in clear weather falls short of the range due to the height at which it is placed. Thus, a light standing 200 feet above the sea, and only recorded as visible at 10 miles in clear weather, is manifestly of little brilliancy, as its height would permit it to be seen over 20 miles, if of any power. (*See* table in Light List above mentioned.)

8. *Fog Signals.*—Sound is conveyed in a very capricious way through the atmosphere. Apart from wind, large areas of silence have been found in different directions and at different distances from the origin of a sound, even in clear weather. Therefore too much confidence should not be felt in hearing a fog signal. The apparatus, moreover, for sounding the signal often requires some time before it is in readiness to act. A fog often creeps imperceptibly towards the land, and is not observed by the people at a lighthouse until it is upon them; whereas a ship may have been for many hours in it, and approaching the land. In such a case no signal may be sounded. When sound has to travel against the wind, it may be thrown upwards; in such a case, a man aloft might hear it when it is inaudible on deck.

Taken together, these facts should induce the utmost caution in closing the land in fogs. The lead is generally the only safe guide.

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9. *Tides and Tidal Streams.*—In navigating coasts where the tidal range is considerable, caution is always necessary. It should be remembered that there are indraughts to all bays and bights, although the general run of the stream may be parallel to the shore.

The turn of the tidal stream off shore is seldom coincident with the time of high and low water on the shore. In open channels, the tidal stream ordinarily overruns the turn of the vertical movement of the tide by three hours, forming what is usually known as tide and half-tide, the effect of which is that at high and low water by the shore the stream is running at its greatest velocity.

In crossing a bar or shallow flats, the table (B) at page 98 of the Tide Tables will be found of great assistance in calculating how much the water has risen or fallen at any hour of the tide.

On coasts where there is much diurnal inequality in the tides, the amount of rise and fall can never be depended upon, and additional caution is necessary.

It should also be remembered that at times the tide falls below the level of low-water ordinary springs. This always occurs on the coasts of Europe at the equinoxes, but in other parts of the world, and especially in the tropics, such periodic low tides may coincide more frequently with the solstices. Wind or a high barometer may produce it at any time, and the amount varies with locality. When the moon's perigee coincides with the full or new moon the same effect is often produced.

10. *Current Arrows* on charts only show the most usual or the mean direction of a tidal stream or current. It must never be assumed that the direction of a stream will not vary from that indicated by the arrow. In the same manner, the rate of a stream constantly varies with circumstances, and the rate given on the chart is merely the mean of those found during the survey, possibly from very few observations.

11. *Fixing Position.*—The most accurate method of fixing a position relative to the shore, is by angles between well-defined objects on the chart. All ships are now being supplied with a station pointer, and this method should be used whenever possible.

Two things are, however, necessary to its successful employment. First, that the objects be well chosen; and second, that the observer is skilful and rapid in his use of the sextant.

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For the former, reference can be had to the pamphlet on the use of the station pointer, which is in every chart box.

The latter is only to be obtained by practice.

It will readily be seen that in war time, when the compass may be knocked away, or rifle-fire may make it undesirable to expose the person more than necessary, a sextant offers great advantages, as angles can be obtained from any position whence the objects are visible. It is this contingency that makes it especially desirable that all navigating officers should become expert in this method of fixing a ship's position.

In many narrow waters also, where the objects may yet be at some distance, as in coral harbours or narrow passages among mud banks, navigation by sextant and station pointer is invaluable, as a true position can only be obtained by its means. A small error in either taking or plotting a bearing under such circumstances may put the ship ashore.

It is not intended that the use of the compass to fix the ship should be given up; there are many circumstances in which it may be usefully employed, but errors more readily creep into a position so fixed.

In all cases where great accuracy of position is desired, angles should invariably be used, such as the fixing of a rock or shoal, or of additions to a chart, as fresh soundings or new buildings. In all such cases angles should be taken to several objects, the more the better; but five objects is a good number, as the four angles thus obtained not only prevent any errors, but they at once furnish a means of checking the accuracy of the chart itself. In the case of ordinary soundings, it is only necessary to take a third angle now and then; firstly, to check the general accuracy of the chart as above stated; secondly, to make certain that the more important soundings, as at the end of a line, are correctly placed.

Sometimes, when only two objects are visible, a compass bearing and sextant angle may be used with advantage.

In passing near a point of land, or an island, the method of fixing by doubling the angle on the bow is invaluable. The ordinary form of it, the so-called "four-point bearing," when the bearing is taken four points on the bow, and on the beam, the distance from the object at the latter position being the distance run between the times of taking the two bearings, gives an excellent fix for a departure, but does not ensure safety, as the point, and probably the rocks off it, are abeam before the position is obtained.

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By taking the bearings of two points and four points on the bow, a very good position is obtained before the object is passed; the distance of the latter at the second position being, as before, equal to the distance run in the interval, allowing for current.

A table of factors, by which to multiply the distance run, to obtain the distance of the object when any number of degrees between the two bearings has been observed, is now supplied in all chart boxes.

The use of a danger angle in passing outlying rocks with land behind should also not be forgotten. In employing this method, however, caution is necessary, as should the chart be not accurate, *i.e.*, should the objects selected be not quite correctly placed, the angle taken off from it may not serve the purpose. It should not, therefore, be employed when the survey is old or manifestly imperfect.

In fixing by the compass, it must always be remembered that two bearings only are liable to error. An absolute error may be made in either bearing observed; errors may be made in applying the deviation; or errors may creep in in laying them on to the chart. For these reasons, a third or check bearing of some other object should be taken, especially when near the shore or dangers. The coincidence of these three lines will prevent any mistakes.

In ships still fitted with the Admiralty standard compass, the tripod supplied to hold the lamp will be found of great service in fixing position at night, as by its aid a bearing can be as accurately taken as in daylight. With Thomson's compass, bearings can also be accurately observed at night. The utility of this, in connection with ascertaining the change of bearing of an approaching ship's light, should not be forgotten.

Amongst astronomical methods of fixing a ship's position, attention is drawn to the great utility of Sumner's method. A Sumner line, that is, a line drawn through the position (obtained by an assumed latitude and longitude by chronometer) at right angles to the bearing of the sun, as obtained from the azimuth tables, gives at times invaluable information, as the ship must be somewhere on that line provided the chronometer is correct. A deep cast at the same time may often serve to get an approximate position on the line. An early and very accurate position can be also obtained by Sumner's method, by getting longitude by a bright star at daylight when the horizon is well visible, and another longitude by the sun when a few degrees above the horizon, or by observing two or more stars at twilight. The Sumner lines drawn through the two positions thus obtained will, if the bearing of sun and star differ three points or more, give an excellent result.

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12. *Change of Variation of the Compass.*—The gradual change in the variation must not be forgotten in laying down positions by bearing on charts. The magnetic compasses placed on the charts for the purpose of facilitating plotting become in time slightly in error, and in some cases, such as with small scales, or when the lines are long, the displacement of position from neglect of this change may be of importance. The compasses are re-engraved when the error amounts to a quarter of a point, but the chart plates cannot be corrected more frequently from the impossibility of making alterations too often on one spot in a copper plate.

The geographical change in the variation is in some parts of the world sufficiently rapid to need consideration. For instance, in approaching Halifax from Newfoundland the variation changes 10° in less than 500 miles. The variation chart should be consulted on this head.

13. *Local Magnetic Disturbance of the Compass on board Ship.*—The term "local magnetic disturbance" has reference only to the effects on the compass of magnetic masses external to the ship in which it is placed. Observation shows that disturbance of the compass in a ship afloat is experienced only in a few places on the globe.

Magnetic laws do not permit of the supposition that it is the visible land which causes such disturbance, because the effect of a magnetic force diminishes in such rapid proportion as the distance from it increases, that it would require a local centre of magnetic force of an amount absolutely unknown, to affect a compass half a mile distant.

Such deflections of the compass are due to magnetic minerals in the bed of the sea under the ship, and when the water is shallow, and the force strong, the compass may be temporarily deflected when passing over such a spot, but the area of disturbance will be small, unless there are many centres near together.

The law which has hitherto been found to hold good as regards local magnetic disturbance is, that north of the magnetic equator the north end of the compass needle is attracted towards any centre of disturbance; south of the magnetic equator it is repelled.

It is very desirable that whenever a ship passes over an area of local magnetic disturbance, the position should be fixed, and the facts reported as far as they can be ascertained.

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14. ***Use of Oil for Modifying the Effect of Breaking Waves.***—Many experiences of late years have shown that the utility of oil for this purpose is undoubted, and the application simple.

The following may serve for the guidance of seamen, whose attention is called to the fact that a very small quantity of oil, skilfully applied, may prevent much damage both to ships (especially the smaller classes) and to boats, by modifying the action of breaking seas.

The principal facts as to the use of oil are as follows :—

1. On free waves, *i.e.*, waves in deep water, the effect is greatest.

2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain, as nothing can prevent the larger waves from breaking under such circumstances; but even here it is of some service.

3. The heaviest and thickest oils are most effectual. Refined kerosene is of little use; crude petroleum is serviceable when nothing else is obtainable; but all animal and vegetable oils, such as waste oil from the engines, have great effect.

4. A small quantity of oil suffices, if applied in such a manner as to spread to windward.

5. It is useful in a ship or boat, both when running, or lying to, or in wearing.

6. No experiences are related of its use when hoisting a boat up in a sea-way at sea, but it is highly probable that much time and injury to the boat would be saved by its application on such occasions.

7. In cold water, the oil, being thickened by the lower temperature, and not being able to spread freely, will have its effect much reduced. This will vary with the description of oil used.

8. The best method of application in a ship at sea appears to be: hanging over the side, in such a manner as to be in the water, small canvas bags, capable of holding from one to two gallons of oil, such bags being pricked with a sail needle to facilitate leakage of the oil.

The position of these bags should vary with the circumstances. Running before the wind they should be hung on either bow—*e.g.*, from the cathead—and allowed to tow in the water.

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With the wind on the quarter the effect seems to be less than in any other position, as the oil goes astern while the waves come up on the quarter.

Lying to, the weather bow and another position farther aft seem the best places from which to hang the bags, with a sufficient length of line to permit them to draw to windward, while the ship drifts.

9. Crossing a bar with a flood tide, oil poured overboard and allowed to float in ahead of the boat which would follow with a bag towing astern, would appear to be the best plan. As before remarked, under these circumstances the effect cannot be so much trusted.

On a bar with the ebb tide, it would seem to be useless to try oil for the purpose of entering.

10. For boarding a wreck, it is recommended to pour oil overboard to windward of her before going alongside. The effect in this case must greatly depend upon the set of the current, and the circumstances of the depth of water.

11. For a boat riding in bad weather from a sea anchor, it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil is diffused well ahead of the boat, and the bag can be readily hauled on board for refilling if necessary.

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IN THIS WORK THE BEARINGS ARE ALL MAGNETIC, EXCEPT WHERE MARKED AS TRUE.

THE DISTANCES ARE EXPRESSED IN SEA MILES OF 60 TO A DEGREE OF LATITUDE.

A CABLE'S LENGTH IS ASSUMED TO BE EQUAL TO 100 FATHOMS, OR THE TENTH PART OF A MILE.

THE SOUNDINGS ARE REDUCED TO LOW WATER OF ORDINARY SPRING TIDES.

BEARINGS OF SECTOR OF LIGHT ARE GIVEN FROM SEAWARD OR TOWARDS THE LIGHT.

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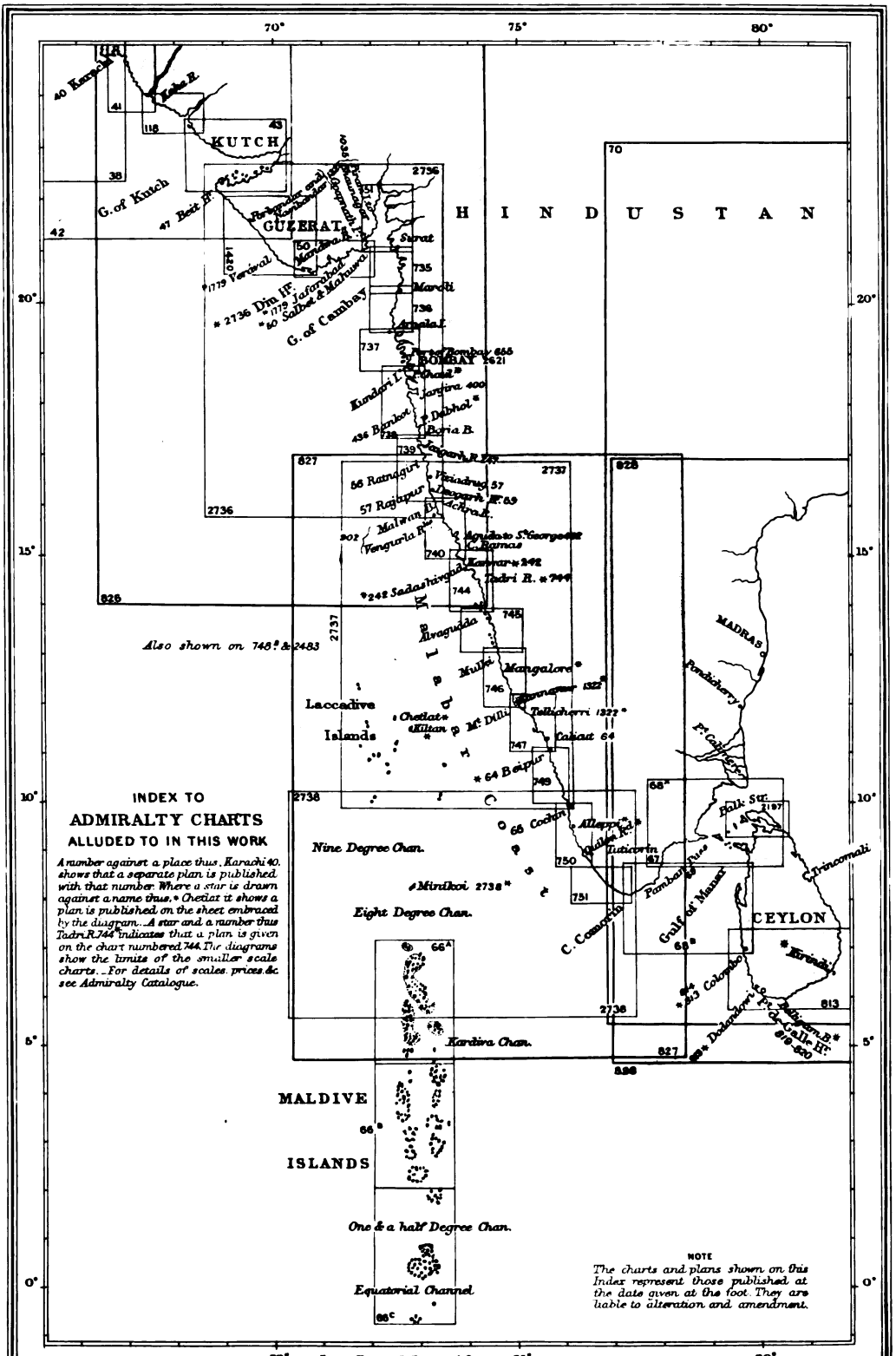

N°. 9A West Coast of Hindustan

Corrected to January 1901.

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THE

WEST COAST OF HINDUSTAN PILOT.

CHAPTER I.

For later information respecting the lights which are described in this Work, seamen should consult the Admiralty List of Lights, Part VI. This List is published early in the current year, corrected to the preceding 31st December.

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certain places, will be found with the description of those places.

The greater portion of Chapter II. of this work, which relates to Ceylon and the northern part of Manar gulf, being in a measure identical with portions of Chapters II. and III., Bay of Bengal pilot, the seaman should consult the book containing the latest information.

HINDUSTAN.—The peninsula of Hindustan forms a great irregular triangle stretching southwards from Asia into the sea, and tapering with a pear-shaped curve to a point at Cape Comorin, its southern extremity. Its northern base rests upon the Himalayan ranges, and it is bounded on the north-west by the Sulaiman range and the hills of Baluchistán; the chief part of its eastern side is washed by the Bay of Bengal, and its western side by the Arabian sea. The large island of Ceylon lies off the south-east end of the peninsula, separated from it by Palk strait and the gulf of Manar.

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The West Coast territory (including that bordering on the gulf of Manar), is divided into several districts and states, all of which are in administrative or political dependence upon Madras and Bombay. Under the Madras Government are the districts of Madura and Tinnevelli (situated eastward of cape Comorin); the native states of Travancore and Cochin, and the districts of Malabar and South Kanara. Hence northwards under the Bombay Government are North Kanara, the Portuguese territory of Goa, districts of Ratnagiri, Kolaba, Bombay city, Thana, Surat, and Broach; the peninsula of Kathiawar, state of Kutch, and the district of Karachi.

CEYLON.—Description.—This important island lying off the south-east extremity of the peninsula of Hindustan, with which it is almost connected by Adam's bridge, is situated between lat. 5° 55′ and 9° 51′ N., and long. 76° 42′ and 81° 55′ E. Its extreme length north and south is 240 miles, greatest breadth near the parallel of Colombo 120 miles, and it contains an area of about 25,365 square miles. The northern part of the island is low and flat, but the southern is mostly mountain region, the highest elevations being Adam's peak 7,353 feet, and Pedrotalagala 8,280 feet above sea-level. The south coast of Ceylon is bold and rocky, and in many parts picturesque; especially where mountains approach the sea, and gentle declivities extend from their base terminating in level beach fringed with groves of cocoa-nut trees. The West coast is low near the sea, and much planted with cocoa-nut and other trees. Estuaries of large area separating low-lying tracts from the mainland are the peculiar feature of the northern part of the west coast. The interior is mostly covered with forest.

Rivers.—The rivers in Ceylon are nothing more than shallow streams navigable only by canoes and flat boats for a short distance. These streams during the heavy rains of the monsoons overflow and inundate the level country; the subsidence of these waters is followed by noxious malaria, prolific of fever, which in some seasons is very deadly.

History.—The Veddahs, some of whom yet survive in Ceylon, are supposed to be the descendants of the aborigines of the island. Colonists from the valley of the Ganges first settled in Ceylon about B.C. 543, whose descendants the Singhalese still form the most important element of the population; though for centuries the Tamils (a race from Southern India who are yet very numerous), were supreme. The island was known to the Romans A.D. 41, but the first European settlements were formed by the Portuguese in 1505; about 150 years later they were dispossessed by the Dutch. In 1795, Great Britain took possession of the Dutch settlements and annexed them to the Presidency of Madras; six years later Ceylon

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was formerly ceded to Britain and became a separate Crown colony. In 1815 the King of Kandy was deposed and banished, when the whole island became subject to the British Crown.

The population of Ceylon by the census of 1891 was found to be 3,008,466, comprising 6,068 Europeans, 21,231 Eurasians, 2,041,158 Singhalese, 723,853 Tamils (chiefly at the north end of the island), Moormen, Mohammedans of Arab descent, and Veddahs; also a few Afghans and Malays.

Products.—Trade.—The staple products of the island are agricultural. About one-fifth of the island is under cultivation, the most important productions being rice, grain, tea, coffee, cinchona, cocoa-nuts, cinnamon, tobacco, plumbago, cacao, and cardamoms.

Ceylon is famous for precious stones, especially catseyes, sapphires, and rubies. An extensive pearl fishery is carried on in the gulf of Manar off the north-west part of the island. The manufacture of salt is a Government monopoly. Among the more important native industries are gold, silver, ivory, and tortoise-shell work, pottery, mats, fans, and wood-carving.

The total exports of Ceylon for the year 1896 (including specie) amounted to Rs. 87,841,357, and the imports to Rs. 87,788,085. About two-thirds of the exports were sent to the United Kingdom. During this year 3,953 vessels of 3,526,323 tons entered, and 3,983 of 3,553,355 tons cleared the ports of Ceylon.

Ports.—Ceylon possesses the good natural harbour of Trincomali on the north-east coast, where there is a capacious and safe anchorage for ships of any size at all seasons; it is, however, inconveniently situated with respect to the general trade routes. Point de Galle has an advantageous position at the south end of the island, but is not a good or well-sheltered anchorage, though it has been much used as a place of call.

At Colombo on the west coast, works still in progress but well advanced, are forming an excellent harbour of considerable extent which is easy of access at all times, and affords complete shelter to the largest ships.

Climate and Rainfall.—The climate of Ceylon, especially on its south-west side is essentially tropical, but varies at its several parts. The heavy rainfall of the summer monsoon is restricted to this portion of the island, while the eastern side receives its most copious rainfall in November and December. The rain of this latter season, however, is not confined to the east coast, but extends inland to the hills, and to the south-west coast, where the average fall in October and November is about that of May, and heavier than during the other months of the south-west

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monsoon. On the north-west, north-east, and south-east coasts of Ceylon the rainfall is comparatively light. At Galle the average annual rainfall is 92·3 inches; at Colombo it amounts to 88·2 inches, of which 26·4 inches falls in October and November and 13 inches in May; February, the driest month, has a rainfall of 2 inches.

In Ceylon generally there is usually a more or less refreshing breeze, and the heat in the plains is less oppressive than in Hindustan. On the coast the temperature is very equable, the mean range being only about 5° above and below the annual mean temperature of 81°. The heat is so largely tempered by ocean breezes and the humidity of the atmosphere, that it is one of the healthiest places in the tropics in which to reside. On the south coast the mean daily temperature varies from 70° to 90°, at Colombo from 68° to 93°; at the hill station, Nuwara Eliya, 6,000 feet above the sea, the thermometer falls at night to freezing point.

TINNEVELLI is a British district occupying the extreme southern and eastern part of the Hindustan peninsula, lying between lat. 8° 9′ and 9° 56′ N., and long. 77° 16′ and 78° 27′ E.; with an area of 5,387 square miles, and a population (1891) of 1,916,095. The southern Ghats on the west, and the gulf of Manar on the south-east, form natural boundaries; between its northern border and Pamban pass there is about 50 miles of the low-lying Madura coast.

Physical Aspects.—Roughly speaking, Tinnevelli is a large plain of an average elevation of 200 feet sloping eastwards; along the western boundary the mountains rise from the plain to a height of above 4,000 feet. The coast at its northern part has but few villages, and is like that of Madura, low and level, with cocoa-nut trees fringing it; scarcely any rising ground occurs inland until behind Manapad, southward of Tuticorin, when the background of red soil covered with palmyra trees and bushes rises gradually to the foot of the magnificent Ghats. Hence southwards numerous fishing villages and small whitewashed churches line the shore, which is altogether devoid of prominent points.

Rivers.—Tinnevelli has several rivers, the principal of which are the Tambraparni and the Vaipar; the latter falls into the sea 16 miles northward of Tuticorin, the former about half that distance to the southward. In the maritime tract are extensive salt marshes, liable to spread greatly during the rainy season.

History.—Tinnevelli as a district has no independent history, its annals being mixed up with those of Madura and Travancore; Ptolemy, A.D. 130, speaks of it as the headquarters of the pearl fishery. Tuticorin was made a port by the Portuguese, whose power lasted until the 17th century, when they were expelled by the Dutch. About 1744, Tinnevelli

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became nominally subject to the Nawab of Arcot, but the place remained in a state of anarchy up to 1781, when the East India Company undertook the administration of affairs. In 1801, upon the suppression of a rebellion, the whole Karnatic, including Tinnevelli, was finally ceded to the British, since which there has been no historical event worth notice.

Products.—Trade.—Tinnevelli is a well watered fertile district, and has more than half its surface actually under cultivation; its chief agricultural products are rice, millet, *chinah*, pulse, plantains, tobacco, coffee, chillies, and oil-seeds. Much cotton is grown in the drier parts. The palmyra palm, from which coarse sugar (*jaggery*) is made, flourishes in the almost rainless tracts towards the south. Irrigation is greatly practised. Cotton, coffee, *jaggery*, chillies, &c. are exported, and sheep, horses, cows, and poultry are also sent to Ceylon. The pearl and *shank* (shell) fisheries are government monoplies. Tuticorin is the only port of importance.

Climate and Rainfall.—Though the rainfall on the hills dividing Tinnevelli from Travancore is probably 200 inches a year, the former receives very little of the south-west monsoon rains, the average annual rainfall of the district being only 24·8 inches. The climate in the north is like that of Madura, hot, dry, and variable, but there is a considerable difference towards the centre, and along the banks of the Tambraparni. The northern monsoon rains reach these quarters about the end of November, last about a month, and are not so heavy as in the Central Karnatic. A tolerable fall of rain is always expected late in January. The mean temperature of Tinnevelli town is 85°; during December and January it falls below 70° at night. April is the hottest month. The district is not considered to be unhealthy.

TRAVANCORE is a native state in the Madras Presidency situated at the extreme south-western part of the peninsula, bounded on the east by the British districts of Madura and Tinnevelli, and on the north by Cochin. This state contains an area of 6,730 square miles, with a population (1891) of 2,557,736, and is in subsidiary alliance with the British Government to which it pays tribute.

Physical Aspects.—The Travancore mountains (generally spoken of as part of the western Ghats), which separate the state on the east from the British districts, rise at some points to an elevation of 8,000 feet above the sea, and are clothed with magnificent primeval forest; while the belt of flat country to an average distance of about 10 miles inland from the sea, is covered with an almost unbroken mass of cocoa-nut and areca palms. The whole surface is undulating and presents a series of hills and

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valleys, traversed from east to west by many rivers, which near the coast spread themselves out into numerous shallow lakes and lagoons; these are connected in places by artificial canals and form an inland line of smooth-water communication, extending nearly the whole length of the coast.

The hill region is very extensive; some of the loftier mountains are entirely detached except near their bases, and they often have a precipitous descent towards the west, on which side they are connected with a succession of lower eminences, that diminish in altitude as they approach the coast. The principal peaks to the southward are Mahendragiri (5,419 feet) at 20 miles north of cape Comorin, and Cuchy Mulla (6,125 feet), about the same distance north-east of Trivandrum. At the head of the Travancore Ghats stands Anaimudi, elevated 8,840 feet; this is the highest peak south of the Himalayas.

Rivers.—Numerous rivers run down from the Ghats and flow by tortuous courses, through high banks and over rocky beds, into the backwater; most of these are navigable only by small craft near the sea. The principal rivers are the Periyar 140 miles in length, Pambai, Achinkoil, Kallada, and the western Tambraparni.

History.—Tradition states that Travancore was colonized by certain Brahmans, known as Namburis, whose rule terminated B.C. 68. During the war with Mysore, 1786–92, this state was the steadfast ally of the British. In 1795 the payment of a subsidy was arranged for, which falling into arrears, indirectly led to a rebellion in 1809; this was speedily repressed, and Travancore has since enjoyed unbroken peace.

Towns.—The chief towns are Trivandrum, the capital and residence of the Maharaja, with a population (1891) of 27,887, Quilon the military headquarters, and Alleppi the principal seaport, population, 22,768.

Products.—Trade.—The principal products are rice, cocoa-nut, and areca palms, pepper, cardamom, coffee, and timber. The chief imports are tobacco, piece-goods, rice, thread, cotton, and copper.

Climate and Rainfall.—In common with the whole belt of coast-line on the western side of India under the Ghats, Travancore has an abundant rainfall, and droughts are almost unknown; the average annual rainfall is 64 inches. Every variety of climate and temperature is found in the state; that of the lower country being much the same as that of Malabar, and influenced in the same way by the long seaboard and heavy south-west monsoon. From March to the beginning of May it is hot, the thermometer often being 90° and 91°, and seldom below 86°. June to September is the wet season when the temperature is not high. October

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to February is the cold season, when there are strong winds and heavy dews; the temperature falls to 64° in January and rarely reaches 80°, except in February. The greatest monthly range of temperature is 22° in January, decreasing gradually to 14° in August, from which time the range steadily becomes greater.

COCHIN is a small native state in subsidiary alliance with the British, and politically connected with Madras. Its former capital (of the same name) has since its capture from the Dutch in 1795, been a British possession. The district of Malabar bounds the state of Cochin on the west, north, and north-east; a small portion is washed by the Arabian sea, and Travancore forms the southern boundary. It lies between lat. 9° 48′ and 10° 50′ N., extends inland to long. 76° 58′ E., has an area of 1,362 square miles, and contains a population (1891) of 722,906.

Physical Aspects.—A striking feature of the country is the series of shallow lakes or backwaters which receive the drainage from the western Ghats, and extend the whole length of the state, affording means of internal water communication. The lands washed by these waters are low, swampy, and liable to be flooded by the rivers overflowing in the monsoon rains; they are in general densely covered with luxuriant cocoa-nut palms, and where embanked yield great quantities of rice. The Anaiamai mountains lie at the back of Cochin, and at their extremity facing the north is the remarkable steep Colingode bluff 5,000 feet high, forming the southern boundary of the Palghat gap.

History.—The present Rajas of Cochin claim to hold their territory by right of lineal descent from the rulers of the country in the 9th century. Cochin succumbed to the Portuguese at the beginning of the 16th century, who were replaced by the Dutch in 1663; under the latter, the state attained great prosperity. After a century, wars between Cochin and other states took place, resulting in the domination of Mysore until 1792, in which year that power passed into the hands of the British. Treaties with the East India Company were made by the Raja of Cochin before the conclusion of the war with Mysore, and again after the suppression of a conspiracy in 1809, when the payment of annual tribute was arranged and political power assumed by the British; since this time the state has no history beyond that of internal reforms. The Dutch held the *town* of Cochin until expelled by the British in 1795; to whom it was formally ceded by treaty in 1814.

Products.—Manufactures.—Rice forms the staple product, the best land supporting three crops annually; cocoa-nut and its products form the chief export of the state. Other crops beside cereals and pulses, are cotton, coffee, indigo, betel-leaf, areca-nut, hemp, flax, sugar, ginger and

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pepper. Ornamental work in metals, and carving in wood and ivory are carried to a point of great excellence; hardware and arms are manufactured. The timber from the forests, and the salt made in the coast region, are government monopolies. The external trade of Cochin is not important.

Climate and Rainfall.—The climate, though very damp, is not particularly unhealthy. The average annual rainfall is 107 inches, of which 82 inches fall during the south-west monsoon, from the months of May to August inclusive. The mean annual temperature is 79·7°, and is very uniform throughout the year, only varying from a monthly average of 77·7° in January to 83·4° in April, which is the dry season. Even during the latter period the air is moist, and frequent showers of rain reduce the temperature; a continuous drought is unknown. Malarious fevers prevail all the year round.

MALABAR.—A British district in the Madras Presidency situated on the coast, lies north of Cochin, westward of Coorg and the Nilgiris, and is bounded north by South Kanara; it has an area of 5,585 square miles, and a population (1891) of 2,652,565. Attached to this district is the *town* of Cochin.

Physical aspects.—Malabar is singularly diversified in its configuration; the great range of the Ghats only interrupted by the Palghat gap, looks down on a country broken by long spurs, extensive ravines, and dense forests. Stretching westward, gentler slopes, rolling downs, and gradually widening valleys, succeed the forest-clad uplands; till near the seaboard the low laterite table-lands shelve into rice plains, and backwaters fringed with cocoa-nut palms. Numerous rivers stretch away to the coast, where they discharge into the all but continuous line of backwaters of varying breadth, lying parallel to the shore. The coast forms a few headlands, and contains the conspicuous hill of Mount Dilli, 850 feet in height.

The mountains of the western Ghats varying from 3,000 to 5,000 feet above sea level on the Coorg slopes, and reaching about 7,000 feet on the Kunda face, run almost in the same direction as the coast; one of the most striking features is the Palghat gap, a complete opening some 25 miles across, in the great backbone of the peninsula.

Rivers.—The chief rivers, navigable inland by small craft for a few miles above tidal influence, are the Beliapatam, Darmapatam, Mahe, Beipur, and Ponani.

History.—Little is known of Malabar before it was visited by Vasco da Gama in 1498, whose successors speedily established themselves at Calicut, Kannanur, and Cochin. In 1656 the Dutch appeared in the Indian seas and soon conquered Kannanur and other places from their rivals; after

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about a century their power began to wane, and they disappeared in 1795. The French first settled at Mahe in 1720, obtained a footing at Calicut in 1752, and subsequently at other places, all of which fell to the British in 1761. After much fighting and many vicissitudes, Malabar was ceded to the East India Company in 1792. Mahe was subsequently restored to the French who still possess it, as also a small factory at Calicut.

Products.—Trade.—The staple products are rice, cocoa-nuts, pepper, spices, oil-seeds, gingelly, grain, coffee, ginger, cardamoms, areca or betel-nut, and cinnamon. There are no local manufactures deserving mention. The principal seats of trade are Kannanur, Tellicherri, Badagara, Calicut, Palghat, and Cochin.

Climate and Rainfall.—Malabar is characterised by a heavy rainfall, a humid climate, and moderate temperature. The south-west monsoon sets in early in May, and brings up heavy clouds which bank up against the Ghat range; this is the hottest time of the year the air being close and oppressive, the temperature at times reaching 92° in the shade. During June, July, and August the rains are frequent and heavy, averaging 80 inches for those months, or two-thirds of the total fall for the year; the climate during the rains is pleasant and healthy. The rains slacken by October, and the north-east monsoon setting in brings cool breezes which reduce the temperature; this sometimes falls to 60° in the shade in December. In March and April there are frequent thunderstorms. From March to May the temperature ranges generally from 80° to 90° in the shade; in December and January 68° to 80°; and in the rainy season 75° to 85°.

Observations have shown that the maximum fall of rain occurs between 3,000 to 5,000 feet above the sea level; on the west of the Nilgiri hills at this elevation it exceeds 200 inches annually, while at Kannanur on the coast the average rainfall is but 120 inches.

SOUTH KANARA.—A British district in the Madras Presidency bounded on the south by Malabar, on the east by Mysore and Coorg, on the north by North Kanara, and on the west between lat. 12° 5′ and 13° 53′ N. by the Arabian sea. The area of the district is 3,902 square miles, with a population (1891) of 1,056,081. The administrative headquarters and chief town is Mangalore containing 40,922 inhabitants.

Physical aspects.—The western Ghats rising from 3,000 to 6,000 feet form a bulwark boundary on the eastern side of the district; they are crossed by several passes, up to which good cart roads lead from Mangalore. The country is very broken and is covered with extensive forests and abundant vegetation; rice is largely grown in the valleys, and

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numerous groves of cocoa-nut palms stud the coast. The seaboard for from 5 to 25 miles inland may be roughly described as a tableland of laterite 200 to 400 feet high rising to 600 feet towards the Ghats, bounded by the lower spurs running down from the range.

Rivers.—South Kanara is intersected with rivers taking their rise in the Ghats, which become raging torrents during the heavy rains of the monsoon; many of them admit of a considerable boat traffic during the fair weather for 15 to 25 miles from their mouths. The chief rivers are the Netravati, Gurpur, and the Chendragiri.

History.—The early history of Kanara is involved in obscurity, but in 1259 A.D. a Pandyan prince conquered the country, whose successors ruled for 84 years. Several fresh dynasties fought their way to power in this region, the boundaries of which was subject to frequent changes, until in 1763 Haidar Ali of Mysore gained the ascendancy. Five years later the British captured Haidar's fleet and occupied Mangalore temporarily, but South Kanara did not finally become a British possession until 1791.

Products.—Trade.—The principal products of South Kanara are timber, bamboo, cardamoms, catechu, cinnamon, gums, and dyes, the staple crop being rice. The chief articles of trade are coffee, rice, salt, coir, yarn, betel-nuts, oil, and seeds; the principal imports being piece-goods, cotton, twist, yarn, oils, and salt. The district is rich in a fine clay well adapted for pottery, and the manufacture of machine-made tiles and bricks is pursued.

Climate and Rainfall.—The district of South Kanara is generally healthy, but fever is not uncommon, and is probably due to the excessive damp and the malarial poison developed from decaying vegetation. It is the most prevalent during the monsoon, or from June to October. The average annual rainfall amounts to about 140 inches. The mean temperature on the seaboard is 84°.

NORTH KANARA, the most southerly of the coast districts of Bombay, lies between South Kanara and the territory of Goa, and extends from the sea to long. 75° 7′ E. It has an area of 3,910 square miles, and in 1891 contained a population of 446,351.

Physical Aspects.—The western Ghats varying in height from 2,500 to 3,000 feet run through the district, separating the uplands from the lowlands of Payanghat, a belt from 5 to 15 miles in breadth. The coast line is only broken by Karwar headland in the north, and by the estuaries of the rivers and the mouths of smaller streams, which lead into numerous lagoons that wind several miles into the interior. The

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shore is generally sandy, and fringing its margin behind the lagoons rise groves of cocoa-nut trees, inland of which stretches a narrow strip of level rice land. From this belt rise a few smooth, flat-backed hills from 200 to 300 feet high; and at places it is covered by lofty rugged densely wooded spurs, which maintain almost to the coast a height of above 1,000 feet. The forests of North Kanara, chiefly of teak with smooth stems 70 feet in height, form its principal feature. Wild animals are numerous.

Rivers.—Flowing westward from the Ghats are several rivers, the most important of which are the Shirawati, Tadri, Gangawali, and the Kalinadi. The former of these, plunging over a cliff 825 feet in height, about 35 miles above the town of Honawar, forms the famous Gersoppa Falls.

Products.—Trade.—Rice, sugar-cane, and safflower are grown to a considerable extent, also cocoa-nuts, areca-nuts, cardamoms, and pepper. The exports are considerable, the principal articles being rice, cotton, timber, cocoa-nuts, and spices. The carvers in sandal-wood and ebony at Karwar and Kumpta are celebrated. Salt is one of the chief manufactures.

Climate and Rainfall.—Fever of a severe type is prevalent. The rainfall varies on the coast from 163 inches a year at Kumpta to 114 inches at Karwar, of which at the latter place 102 inches fall in June, July, and August. In the uplands the rainfall is less, being on an average about 72 inches.

GOA.—A Portuguese settlement on the Malabar coast, lying between lat. 14° 54′ and 15° 43′ N., extending from the sea to long. 74° 24′ E. It is bounded on the south by Kanara, on the east by the western Ghats, and on the north by the river Tirakul separating it from Sawantwari state and the district of Ratnagiri. Total area 1,062 square miles, and a population in 1891 of 561,384. Goa forms a patch of foreign territory on the Bombay coast, and is surrounded on all sides by British districts. The other Portuguese possessions in Western India, are Daman to the north of Bombay, and Diu, a town on an island off the Guzerat coast. Panjim is now the capital of Portuguese India, and the centre of trade and government.

History.—Goa is supposed to have been swayed by the Kadambas kings for 1,200 years prior to its falling into the hands of the Mohammedans under Malik Tubliga in 1312, who were expelled in 1370; successive conquerors ruled until Goa was captured by the Portuguese, 1510. Goa reached the summit of its prosperity at the end of the

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16th century, at which time it was a place of wonderful military, ecclesiastical, and commercial magnificence. It was blockaded by the Dutch in 1603 and 1639, and suffered greatly from the appearance of that power in Indian waters. Frequent wars with native states have taken place, causing various alterations in the boundaries, but the Portuguese were never entirely vanquished. Owing to British supremacy throughout India, Goa now enjoys peace from outside interference.

Mountains.—Goa is a hilly country, and its distinguishing feature is the Sahyadri mountains, which branch off westwards across the territory into numerous spurs and ridges. These mountain ranges are studded with isolated peaks, of which some of the most important are—Sonsagar, 3,827 feet above sea level, and Vaguerim, 3,500 feet; Dudeagar-Canacona peak, 2,020 feet, and East peak, 1,470 feet, near the coast at the southern end of the territory, are conspicuous from seaward.

Rivers.—The country is intersected by numerous rivers which are generally navigable; the chief of which from southwards are the Sal, Juari, Mandavi, 38 miles in length with both the ancient and modern metropolis situated on its banks, Chapora and Tirakul.

Products.—Trade.—The staple produce of the country is rice; others are cocoa-nut, areca-palm, cereals, chillies, ginger, and tumeric. Few manufacturing industries exist. The principal exports are cotton-stuffs, cocoa-nuts, betel-nuts, cinnamon, pepper, gum, coir-work, and salt. The chief imports are rice, cloth, refined sugar, wines, tobacco, glassware, and hardware. During the year 1896, 827 vessels of 145,320 tons entered the port of Murmagao.

Climate and Rainfall.—The climate conduces to fevers and dysentry; the most unhealthy months being March, April, September, and October. The healthiest season is from November to February. April and May, just before the rains, is the hottest period, the temperature then ranging from 89° to 91° in the shade. The average annual rainfall is 100 inches.

RATNAGIRI.—A British district in the Konkan division of the Bombay Presidency, lying between the sea and long. 74° 2′ E., bounded southwards by the Portuguese possession of Goa, and on the north by the district of Kolaba. It has an area of 3,922 square miles, and contains (1891) a population of 1,105,926. Ratnagiri formed part of the dominions of the Peshwa, and was annexed by the British Government in 1818, on the overthrow of Baji Rao. The southern Konkan has always been a great recruiting ground for the Sepoy regiments; the inhabitants also supply Bombay with a large number of their labourers.

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Physical Aspects.—The district is generally rocky and rugged; near the coast it consists of bare elevated plateaux, intersected by numerous creeks and navigable rivers, flowing between steep and lofty hills. About ten miles inland the country becomes more open, but a little farther back it is occupied by spurs of the Sahyadri hills. The range itself runs parallel to the coast, forming the eastern boundary of the district; it varies in height, roughly, from 2,000 to 3,000 feet, though some of the peaks attain an altitude of nearly 5,000 feet. The coast is almost uniformly rocky, and consists of small bays and coves shut in between jutting headlands, and edged with white sand.

Rivers.—Many of the rivers are accessible to native craft for 20 or 30 miles from the coast, and have important towns situated at their farthest navigable point. The chief of these streams from southwards, are the Viziadrug, Rajapur, Ratnagiri, Shastri (tidal for 28 miles), Washishti (practicable 25 miles to Chiplun), and the Bankot or Savitri, navigable to Mahad at 36 miles from the coast.

Products.—Trade.—Ratnagiri, upon the whole, is a poor district, and nearly two-thirds of the population are but indifferently supported by agriculture, the soil being generally stiff clay, often mixed with gravel. Palms flourish along the coast, and hemp is grown for making fishing nets. Splendid forests cover the face of the Ghats. Fishing is the principal industry, and a considerable quantity of fish is exported. The chief imports are, salt, timber, catechu, and grain. The exports are fish, fuel, and bamboos.

Climate and Rainfall.—The climate of the Konkan is hot, relaxing, and moist, but not unhealthy; fevers of various types are the most prevalent diseases. The average rainfall for the year amounts to 111 inches at Vengurla, and to 103·6 inches at Ratnagiri.

KOLABA is a British district (embracing the small native state of Janjira of 151 square miles), lying between Ratnagiri and Bombay harbour, and extending from the sea to the Sahyadri range. It contains an area of 1,872 square miles, with a population in 1891 of 509,584. The chief town is Alibagh.

Physical Aspects.—The district abounds in hills, some being spurs of considerable regularity and height, running westward at right angles to the main range, while others are isolated peaks or lofty detached ridges. A series of ranges run north and south between the Sahyadri hills and the coast. The sea frontage is mostly fringed by a belt of cocoa-nut and betel-nut palms, behind which lies a stretch of flat, rice-producing country.

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Rivers.—Several streams, rising in the hills, pass through the district to the sea. Tidal inlets, running inland for a considerable distance, form convenient trade highways, the principal of which are Bankot creek at the south, Chaul or Kundalika river in the west, and the Amba river on the north. The latter is navigable to Nagothna, 21 miles from its mouth.

History.—Kolaba island, situated just outside Alibagh harbour formed in ancient times a shelter for the pirate fleets of Western India; it was made a regular stronghold by Marhatta Sivaji in 1662, and successfully withstood a combined attack of British ships and Portuguese troops in 1722. Fifty years later the pirate chief, Raja Angria, lived here in great splendour, and survived sharp measures against him by Clive. The rise of the Indian navy eventually suppressed piracy in Bombay waters. Nearly the whole of the Kolaba district formed part of the dominions of Peshwa, and were annexed in 1818 on the overthrow of Baji Rao. Alibagh lapsed to the Paramount Power in 1839.

Products.—Trade.—Rice is the staple product of the district and forms the chief article of export; other articles are salt, firewood, timber, cocoa-nuts, hemp, vegetables, and fruit. The imports consists of grain, piece-goods, oil, butter, sugar, and molasses. Local manufactures barely suffice for home wants. Silk weaving is practised at Chaul.

Climate and Rainfall.—The climate is hot, relaxing, and moist, but not generally unhealthy; though fever and dysentery prevail from October to January, especially in low-lying districts. Owing to the monsoon rainfall being precipitated upon the Ghats behind, the Konkan is peculiarly exempt from drought and famine; the average yearly rainfall is about 100 inches. The temperature ranges from 76° during the cold season, to about 90° in the hot weather and after rains.

BOMBAY.—The Western Presidency of British India comprises a number of British districts, and Native states under the protection of the Indian Government, and extends irregularly between the limits of lat. 13° 53′ and 28° 47′ N., and long. 66° 43′ and 76° 30′ E. Those regions of importance bordering the coast are briefly described in detail.

The **city of Bombay,** the capital of the Province, residence of the Governor, headquarters of all administrative departments, and the principal seaport of western India, is, including the suburbs, regarded for certain purposes as constituting a district by itself, with an area of 22 square miles and a population (1891) of 821,764. Detailed information will be found at pages 196–216.

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History.—The island of Bombay was in the occupation of the Portuguese as early as 1532, and was ceded by them to Charles II. in 1661, as part of the dowry of his queen, Catharina of Braganza; but after seven years the king transferred ownership to the East India Company. The adjoining islands of Salsette and Karanja still remained in the possession of the Portuguese. After the Marhatta war of 1774–1782, all the Bombay group of islands and the town of Thana were permanently occupied by the British. Bombay became the capital of a large territory, and attained its pre-eminence in Western India upon the downfall of the Peshwa in 1818.

Climate and Rainfall.—The climate of Bombay is not so excessively hot as some other parts of India. The cold weather lasts during the time of the north-east monsoon from November to May. The south-west monsoon begins about the second week in June, and the rain continues with great regularity until the end of September. The hottest months are May and October, but even then the heat is tempered by cool breezes from the sea. From observations extending over a period of 28 years the mean annual temperature at Bombay was found to be 79·1° F., ranging from 73·4° in January to 84° in May. The average rainfall of the year is 70·3 inches, of which 67 inches fall during June to September (inclusive).

THANA (Tanna).—A British district on the North Konkan coast, lying between Kolaba district on the south, and the Portuguese territory of Daman and Surat district on the north; it extends inland to long. 73° 52′ E. Thana has an area of 3,935 square miles, and contains a population (1891) of 904,868.

Physical Aspects.—Thana consists of a strip of low land intersected by hilly tracts, rising to elevations varying from 100 to 2,600 feet. Towards the east and north-east, the country is elevated and covered with trees; near the coast the land is low and fertile, with populous villages, and here palm trees grow in abundance. The Waitarna, navigable for about 20 miles from its mouth, is the only considerable river, and Bassein creek, the one important inlet.

Mountains.—Among the most considerable hills are those running through Salsette, culminating in Thana peak, 1,526 feet in height; Bassein peak, 2,132 feet; Tarapur peak, 1,550 feet, and the high land of St. John, 1,761 feet.

History.—The territory comprised in the district of Thana, formed part of the dominions of the Peshwa, who may be said to have established his sovereignty in 1749; it was annexed by the Bombay Government in 1818, on the overthrow of Baji Rao.

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Products.--Trade.—Agriculture supports 64 per cent. of the entire population, rice being by far the most important grain crop; pulses, oil-seeds, fibres and sugar-cane are also cultivated. The forests supply much timber and firewood; the sea-fishing is very productive. The chief articles of export are rice, salt, wood, lime and dried fish. Cloth, grain, tobacco, cocoa-nuts and sugar, form the principal articles of import. The leading industries of the district are hand-loom weaving of silk and cotton; also spinning and weaving of cotton in steam factories. Other industries are distilleries, and chemical, dyeing, and toddy factories.

Climate and Rainfall.—The climate is exceedingly moist for fully half the year, and fever is the prevailing disease. The annual average rainfall is 94 inches.

SURAT is a British district in Guzerat, at the entrance to the gulf of Cambay, lying northward of Thana district and the Portuguese territory of Daman; and is situated between the sea, and long. 73° 30′ E., and bounded northward, in about lat. 21° 28′ N., by Broach district. It has an area of 1,662 square square miles, and a population (1891) of 649,989. The administrative headquarters are at the city of Surat.

Physical Aspects.—Surat district consists of a broad alluvial plain, with small hillocks of drifted sand fringing the greater part of the coast; which in some parts is dry and barren, and in others watered by springs. Through the openings of the river mouths, the tide runs up behind the barrier of sand-hills, and floods a large area of salt-marshes. Beyond spreads a belt of highly cultivated land, restricted by the hills towards the south to a breadth of little more than 15 miles; but with a width of about 60 miles at the north, where the river Tapti forms a deep and fertile delta. The eastern border of the district consists of less fruitful lands, interspersed with mounds of rising ground, and becomes a wild region passing gradually into the hills and forests of the Dangs, where cultivation entirely disappears.

Rivers.—The chief rivers of Surat are the Tapti and the Kim, on the former of which stands the city of Surat. The Tapti rises near Nagpore, 2,000 feet above the sea, and runs about 400 miles to the gulf of Cambay. During the rainy reason it is subject to sudden and tremendous floods, but in the dry season it becomes a mere chain of pools; small steam vessels can at high tide, however, proceed to Surat 15 miles from its mouth. The Kim, which is the northern boundary of the Surat district, has a course of 70 miles, the town of Kim being 20 miles from its mouth; the estuary dries at low water.

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History.—Surat was one of the earliest portions of India brought into close relations with European countries; and its history merges almost entirely into that of its capital, long, the greatest maritime city of the peninsula. The town was burnt by the Portuguese 1512, and again 1531, at which time it was in possession of the Ahmadabad kings. The Emperor Akbar captured the place 1573, and for 160 years the whole district remained subject to the Mughal court, and Surat rose to be one of the first mercantile cities of India. The English first appeared here 1608, and established a factory 1612; the Dutch also made a settlement shortly after; up to this period the Portuguese had been undisputed masters of the Surat seas. In 1664 and subsequent years Surat was pillaged by the Marhatta Sivaji, but it continued to flourish, and in 1695 was described as "the prime mart of India," which position it held until the rise of Bombay.

An independent native dynasty ruled at Surat from 1733 to 1759, when in consequence of internal anarchy the English attacked the place and became supreme; though the Nawabs retained a show of independence until 1800, when the Government became wholly invested in the British. The district was brought into its present limits by 1839; the title of Nawab became extinct 1842.

Products.—Trade.—More than half the population are supported by agriculture, rice and millet being the staple crops; *kodra* and *nagli* form the food of the poorest classes. Cotton is grown chiefly in the valley of the Tapti, and sugar-cane flourishes in garden land. The exports include grain, pulse, fruit, timber, and bamboos; the imports comprise tobacco, cotton seed, iron, cocoa-nuts, and European goods. Spinning and weaving of cotton is the chief manufacture, and employs almost the entire female population. Silk brocade and embroidery are also largely manufactured by handlooms.

Climate and Rainfall.—The climate of Surat district varies greatly with the distance from the sea; an equable temperature prevails near the coast, which is not found 8 to 10 miles inland. Mandvi in the north-east and the Dangs are unhealthy, a severe type of malarious fever prevailing. The temperature of Surat city has, by the average over a term of years, been found to range from 60° to 87° in January, and from 80° to 99° in May. The coast possesses a much lighter rainfall than the interior, the annual average ranging from 30 to 72 inches. At Surat city the annual average is 41·24 inches, of which nearly 40 inches falls from June to September inclusive.

BROACH.—A British district on the eastern side of the gulf of Cambay, lying between Surat and lat. 22° 17′ N., with an area of 1,463

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square miles, and a population of 341,490. The district forms an alluvial plain sloping gently westwards, varying in breadth from 20 to 40 miles; with the exception of a few hillocks of sand-drift along the coast, there is no rising round. The soil is highly fertile and well cultivated.

Rivers.—The rivers Kim and Mahi form respectively the southern and northern limits of Broach district, and between them the Narbada and Dhadar discharge their waters through the plain. The Narbada has its source in the highest part of central India, at an elevation of about 3,500 feet above the sea; and after running in a westerly direction 800 miles it falls into the gulf of Cambay at about 30 miles north of Tapti river entrance. The tidal influence is felt about 55 miles from the sea, and vessels of 100 tons can ascend to the town of Broach, nearly 30 miles from its mouth.

The Dhadar about 70 miles in length, the entrance to which is situated 17 miles north of the Narbada, is navigable by small steam vessels for 10 miles to Tankari. The city of Baroda stands on an affluent of this river. The Mahi has a course of about 350 miles from its source at an elevation of 1,850 feet above sea level. At the town of Cambay near its embouchure the bore-wave is experienced every flood tide at springs, when the maximum initial velocity of the tide is (for a few minutes) at the rate of 10 miles an hour.

History.—The Portuguese were the first Europeans that visited Broach; they plundered the city in 1536, and again in 1546. The English established a factory at the town for trade purposes in 1616, but had no political relations with the native rulers until 1759. Broach was taken by a British expedition sent from Surat 1772, relinquished 1783, retaken from Sindhia 1803; and under the treaty of Poona, received territorial additions 1817.

Products.—Trade.—The most important part of the Broach trade is the export of cotton, valued at 84 per cent. of the whole; other exports are wheat, grain, cotton seed, *mahua* flowers, tiles, and firewood. The imports consist of molasses, rice, betel-nut, timber, coal, iron, cocoa-nut, and stone for building. Handloom weaving is a native industry.

Climate.—Rainfall.—The district is comparatively healthy, and the climate not unpleasant. Frosts are said to occur at intervals, sometimes as in 1835, sufficiently severe to destroy the crops. April is the hottest month of the year. West and south-west winds blow from May to October, when the rainy season ends. The average annual rainfall is 39 inches.

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KATHIAWAR.—The peninsula of Kathiawar, a portion of Guzerat lying between the gulfs of Cambay and Kutch, is about 220 miles in extreme length, and 165 miles wide at the broadest part; its area is 20,559 square miles, and it contains a population (1891) of 2,752,404. It is divided into no less than 188 separate states, of which 96 are tributary to the British government; the whole are controlled by a Political Agent.

History.—The barest outline only can be given of the history of a province comprising so many separate states. Mohammedan kings of Guzerat reigned from 1403 to 1573, when Akbar conquered the country, and subjected the tributary chiefs of Kathiawar. The Portuguese appeared on the coast in 1528, and eight years after established themselves at Diu, which is still in their possession. In 1705 the Mahrattas entered Guzerat, and by 1760 were firmly established; wars, however, were frequent, and in 1803 some of the weaker states sought protection from the British, who, four years later, advanced into Kathiawar. Concessions were made by Peshwa in 1817, and by the Gaekwar 1820; and the sole supreme power has been with the government of Bombay since 1822.

Physical Aspects.—Hills.—The surface of Kathiawar peninsula is generally undulating, with low ranges of hills running in irregular directions; but towards the south-west part there are extensive districts quite mountainous. The Gir range, at 31 miles north of Diu head, attains an elevation of 2,124 feet, and Nandivelo mountain at its east end is 1,735 feet high; from the latter, this range extends west-north-westward nearly 40 miles. Junagarh mountain, at about 20 miles from the Gir hills, and 35 miles from Mangrol, is a peak of conical form reaching a height of 3,662 feet. Still farther west is the Barda group, about 20 miles in extent, the highest peak of which is 2,053 feet above sea-level. The northern portion of the country is almost universally flat.

Rivers.—The Sabarmati at the eastern boundary of Kathiawar is the only river of importance in the province; it runs past the city of Ahmadabad and discharges into the gulf of Cambay, at nearly 200 miles from its source in Rajputana. Its navigation is limited to about 12 miles from the sea, and is affected by the bore-wave. Other rivers are the Satrunji, which rises in the Gir hills and empties itself into the gulf of Cambay, and the Bhadar, which after a course of 115 miles, falls into the sea at Navibandar.

Towns.—The principal are Nawanagar, with a population in 1891 of 48,530; Bhaunagar, 57,653; Junagarh, 31,640; Rajkot, 29,247, the headquarters of the Political Agent; Porbandar, 18,805; Mangrol, and Verával.

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Products.—Trade.—The principal products are cotton, *bajra*, and *joar*; and in some parts sugar-cane, turmeric, and wild indigo. Horses are bred in large quantities, and sheep are plentiful in some parts. Iron is found in Barda and Hallar. Silk and cloth are manufactured. The chief exports are wool, grains, and raw cotton; the imports are cotton manufactures, metals, and sugar.

Climate and Rainfall.—The climate generally is good and healthy, especially near the sea; though the excessive and sultry heat from early April to mid-July is very trying. At Mahuwa, on the south coast, the hottest months are April, May, and June; the temperature also rises in October after the cessation of the monsoon. The average temperature in May ranges from 83·7° at 6 a.m. to 96·4° at 2 p.m.; in December from 63·3° at 6 a.m. to 92·5° at 2 p.m. The average annual rainfall at Mahuwa is 22·2 inches, at Salbet 25 inches; most of this falls in July, though showers sometimes occur in January. At Beit, on the north coast, the annual rainfall is about 10 inches, the greater part falling in July and August.

KUTCH.—A native state in the Bombay Presidency, situated on the coast between the gulf of Kutch and the province of Sind, and extending inland to long. 71° 45′ E. The whole territory of Kutch, being almost entirely cut off from the continent of India by the Kori branch of the Indus and the Rann, is practically an island. The area of the State, exclusive of the Rann, is about 6,500 square miles; the population (1891) numbers 558,415. Bhuj, the residence of the Rao, is the capital, and contains a population of 25,421.

Physical Aspects.—On the whole the country is treeless, barren, and rocky, with ranges of hills and isolated peaks; but it contains many well-tilled valleys and tracts of rich pasture land. At the south, behind a high bank of sand that lines the sea-coast, there is a low, fertile plain from 20 to 30 miles wide; inland of which a broad belt of hilly ground from 500 to 1,000 feet high, stretches east and west, having a more elevated range beyond, lying parallel to it. Nanu, the centre of the southern hills, is 1,280 feet above the sea. Patcham Pir, the highest point in Kutch, 1,450 feet, stands out from the bed of the great Rann.

There are no permanent rivers in Kutch, but during the rainy season many streams of considerable size flow from the central ranges of hills in a northerly direction towards the Rann, and southerly to the gulf of Kutch; during the rest of the year the courses of these streams are marked by a succession of detached pools.

The Rann.—The most striking physical feature of Kutch is the Rann or salt desert, stretching along the north and east sides of the state.

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The northern Rann is about 160 miles from east to west, and 80 miles broad, with an estimated area of about 7,000 square miles. The eastern Rann is about 70 miles in length, east and west, and covers an area of nearly 2,000 square miles. In appearance and general character these Ranns differ but little; the dark soil is generally caked by the action of the sun on the saline particles with which it is impregnated. At times the whole surface, particularly of the eastern part of the Rann, is covered with salt. With the exception of some of the smaller islands, where grass and a few stunted bushes may be found, there is no sign of vegetable life; but wild asses and antelope roam over the place and find subsistence. During the south-west monsoon, high tides cover the Rann to a depth of one or two feet.

History.—The Jareja Rajputs, descendants of the Summa tribe, to which branch the Rao of Kutch belongs, are said to have emigrated from Sind about the 15th century, and were ruled in Kutch under three branches until 1540. About this period the Mohammedan king of Ahmadabad assisted Khengar, the ruler of one branch, in making himself master of the whole province, and from Khengar the present Rao, who succeeded his father in 1876, is fifteenth in descent.

Products.—Trade.—Iron, coal of an inferior description, and millstones are found, also building stone in abundance; alum and a coarse variety of saltpetre are produced. Wheat and barley of indifferent quality are cultivated, also cotton, millet, and pulse. There are large herds of camels, cows, and buffaloes; the country is famous for its horses. The manufacture of silk and cotton is of importance.

Climate and Rainfall.—The climate is agreeable throughout the year, along the sea-coast; and over the whole province, for nearly nine months, it is cool and healthy. But in April and May burning winds prevail, and again during October and part of November, the sultry heat becomes excessive and very trying. On the coast, about the latter part of January, the temperature averages about 65° during the day, and has been recorded as low as 50° in the morning. Kutch is almost beyond the rain-bringing influence of the south-west monsoon; the average annual rainfall is 14·3 inches, but it varies considerably, ranging from one to 35 inches.

KARACHI.—A British district in the province of Sind lying between Kutch and Baluchistán, and between the sea and long. 68° 49′ E.; its area is 14,182 square miles, and population (1891), 560,880. The administrative head-quarters are at the city of Karachi.

Physical Aspects.—Karachi district possesses a hilly western region, from which lateral ranges, with spurs and offshoots, push forward.

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The country as it runs south-eastward is a vast sloping plain, becoming more and more level, until in the extreme south the Indus delta grows into a broad expanse of low, flat alluvium, through which run numerous creeks communicating with the ocean. The whole sea-coast, except that part between Karachi town and cape Monze where the Pab hills approach the shore, is low, flat, submerged at spring tides, and consists in fact of a series of mud-banks deposited by the Indus, or in a few places of sand-hills blown from seaward.

Rivers.—The Indus, the great river of western India, having a total length of 1,800 miles, has its source in Thibet, at an elevation of about 16,000 feet above the sea; whence it runs in a north-westerly direction through the middle of Kashmir to Kohistan, where, pursuing a west and south-west course it reaches the Punjab frontier at 812 miles from its source. Continuing farther about 50 miles until near Attock, and at the height of 2,000 feet above the sea, it receives the Kabul river of nearly equal volume, and flows southwards along the western side of the Punjab. Just above Mithankot, at about 490 miles from the coast, the Indus receives the combined waters of the Jelum, Chinab, Ravi, Bias, and Sutlej, which after various junctions have formed one united stream. The elevation of the Indus at Methankot has fallen to 250 feet; thence the river forms the east boundary of the Punjab until it enters Sind, through which province it flows by many mouths into the Arabian sea. Attock is the limit of navigation, which, however, cannot be reached during the floods.

The mouths of the river are subject to frequent and great changes during floods; at present the Kediwári mouth is the principal channel, and that by which country vessels approach the town of Keti. From its shifting channels and sandbanks, and the arid nature of the country through which it flows, the Indus is comparatively of little value as a highway of traffic. The inundation of the country that borders on the Indus is caused by the melting of the snows in the Hindu Kush and Himalaya mountains, which commences at the end of March and continues over September, having attained its maximum in the first week of August. This overflowing of the river banks spreads the alluvium over the country, thus annually renewing the fertility of the soil.

The only other stream of any importance is the Hab, forming the western boundary between Sind and Baluchistán; this river rises in Khelat and has a total length of 100 miles.

History.—Numerous waves of conquest have swept over Sind, from the Arab invasion 713 A.D., to that of the Mughal Emperor Akbar 1591, and of Nadir Shah of Persia 1739. The first connection of the British

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with Sind took place in 1758; but no footing was obtained until Manora was occupied 1839, and important concessions followed. After the battle of Miani and subsequent operations in 1843, Sind was declared a conquered country and added to the British dominions.

Products.—Trade.—Rice forms the staple crop; but wheat, sugar-cane, millets, cotton, and tobacco are also grown. Cattle are reared in the southern plains. There are extensive salt deposits in the district. The local manufactures are confined to Karachi town; Tatta is noted for *lungis*, and Bubak for carpets. Trade centres mainly at the town of Karachi, which is a place of great and growing importance. The principal exports are cotton, wool, oil-seeds, wheat, hides, drugs, silk, and horses; valued (1896–97) at 58,072,345 rupees. The chief imports are piece-goods, cotton-twist, metals, sugar, silk, tea, railway plant, &c., to the value of 72,730,049 rupees. During 1896, as many as 496 vessels, aggregating 596,777 tons, left the port of Karachi.

Climate and Rainfall.—The hill country of Kohistan has a more equitable climate than that of the plains, but near the barren Laki range, the heat often becomes insupportable. The climate of Karachi is generally considered the most salubrious throughout Sind; winds from the westward prevail during the hot weather, and blow almost continuously from March to October.

From November to February, Karachi enjoys pleasant weather, that is at times even cold and bracing. The mean temperature during the year is 77·2° F. The hottest months are May to July; September and October are close and sultry. During June the average mean temperature is 86·7°, ranging from 79·6° to 91·8°. In January the mean is 64·6°, ranging from 51·6° to 73·2°. At Karachi the rainfall is slight and fluctuating, the average annual amount being 7 inches, though sometimes one or two years elapse with scarcely a shower.

MALDIVE ISLANDS.—These islands, grouped in clusters termed atolls, occupy a space 470 miles in length, north and south, and 70 miles east and west, or from latitude 0° 42′ S. to 7° 6′ N., and between longitudes 72° 33′ and 73° 44′ E. There are nineteen atolls or groups: in the centre of the chain they lie in double rows—east and west atolls—from 10 to 25 miles apart; at the north and south extremes of the chain the atolls lie singly.

Barrier reefs encircle those atolls which compose the southern part of the group, but none of the atolls north of latitude 3° 30′ N. have them, excepting in a few detached parts of their circumference.

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The islands are in general not more than 5 or 6 feet above the level of the sea, so that the cocoa-nut trees on them appear on first approach to be growing out of the water. There is no bottom at a depth of 200 fathoms, close to the sea face of the islands and reefs. The natives are of opinion that the islands decrease in number, and gradually waste away; in some the cocoa-nut trees are standing in the sea, in others the submerged black soil is discernible, at low water several feet from the dry beach; the south-east end of an island in Fadiffolu atoll is entirely gone, but marked by a banyan tree in the water.

Near Wahdu island, in Miladummadulu atoll, there is a rocky shoal which was once an island. It is, however, acknowledged that reefs have arisen from the water, and gradually become habitable islands; there is a circular reef in Mále harbour, the outer edge of which is dry at low water, this reef had formerly a depth of 12 feet over its shoalest part.

People.—The Maldive group is inhabited by a civilised race of people, who carry on a considerable trade with the British possessions in India, more particularly with Bengal, Chittagong, Ceylon, and the Malabar coast; and, being Mohammedans, their peculiarly built vessels occasionally make a pilgrim-voyage to the Red sea. They are expert navigators and sailors; schools for teaching navigation are found on some of the islands. They make and repair nautical instruments, such as the astrolabe and quadrant; they copy English nautical tables, and translate the rules of our navigation books into their own language, generally using our numerals, so nearly identical with the Arabic. They are an inoffensive, timid people, with little crime; murder has seldom been known among them, theft and drunkenness are very uncommon.

The men in appearance are of a dark copper colour, rather short, and in person not unlike the natives of Ceylon and the Malabar coast, but at Mále many exhibit in their physical conformation an admixture of the African, doubtless from the Zanzibar slaves, occasionally imported by Maskat vessels. Their language is different from that of either Malabar or Ceylon, though it adopts many words in constant use on the sea-coast; their women are not pretty, and though less secluded than is usually permitted by Mohammedan custom, they are alarmed at the appearance of strangers.

These islanders have been kind in their hospitality to shipwrecked mariners; as exemplified in their humane and liberal conduct towards the crews of vessels wrecked on their atolls.

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Government.—These islands are governed by a Sultan, who acknowledges the suzerainty of the British Government, as rulers of Ceylon, on which island the Maldivians have always been dependent, but the British Government in no way interferes with their internal affairs. The title and rank of the Sultan are hereditary; under him are six viziers or ministers of state, of whom the first in rank is styled Dorhimena, the chief or general of the army; but above these, and second only to the Sultan, is the Fadiyaru, the head priest and judge, civil and religious. The other chief officers are the Hadégiri, or custom-master and public treasurer; and the Míru Baharu, or master-attendant of the port. All these functionaries reside at Mále, or Sultan's island. The Sultan sends an annual embassy to the Governor of Ceylon, claiming the protection and favour of the British Government, and presenting a tribute of cowries, fish, and cakes. The Governor, in return, stipulates for succour to Europeans shipwrecked on the islands.

To the different atolls are appointed one or two chieftains, styled Atoluveri. To all islands having 40 male inhabitants there is a Katibu, who is priest and judge. Every atoll pays a certain fixed revenue, a portion of their produce, to the government at Mále, and trade is not allowed with foreigners or strangers, except at Mále.

Trade.—The whole of the export and import trade of this group of islands, carried on by foreigners, is conducted at Mále, whither the produce of all the other atolls is brought, the dealers from each carrying back in return the produce of other parts to supply the wants of their respective islands. The external trade of Mále consists of two branches, one carried on by traders resorting to that place from Chittagong, Ceylon, and the Malabar coast, or through resident agents on the island; the other by the islanders themselves in their own vessels.

Exports.—The foreign traders call regularly once a year, arriving about March, and leaving with the south-west monsoon about July. They barter principally for bonito (kalu-bili-mas), of which a large quantity is shipped off every season; at Ceylon and Sumatra the demand is greatest, the latter island being supplied by the Chittagong traders. Tortoiseshell, cocoa-nuts, coir yarn, cowries, and a few mats compose the other articles of export. The coir yarn of these islands sells at a higher rate than the ready-made rope of the continent, it being much finer, and of a better colour; the trade in this article is principally carried on in the boats of the islands.

That portion of the external trade which is conducted by the natives is carried on chiefly with Calcutta and Ceylon in boats of 100 to 200 tons

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burden; they leave the islands late in August or early in September, annually, having the south-west monsoon in their favour, and return in December with the north-east monsoon. These boats, from their build and rig, are totally unfit to work to windward, or even to make moderate progress unless the wind be abaft the beam; but smaller trading boats of about 50 tons, whose sailing qualities are somewhat superior, are also used occasionally in trading to Penang and Calcutta.

Imports.—The imports are rice, dates, salt, leaf tobacco, betel nuts, coarse white cloth, cotton, red and white check cotton handkerchiefs, curry-stuff, ghee, china-ware, Indian pottery, and coarse brown sugar; and in small quantities, steel, brass wire, thread, and waist-cloths of various colours.

The Bengal rupee is current in the islands, and is used in all money transactions. A copper coinage struck at Mále has also been in use for more than a century; these coins are termed bodu (large) tari, and kuda (small) tari, and have a nominal exchange value respectively of 25 and 100 to the rupee. Of cowries, 12,000, constituting one *kotte*, can be purchased in the bazaar of Mále for one and a half rupees.

Port dues.—On the arrival of a trading vessel from the eastward near any of the atolls, a boat immediately proceeds out and conducts the vessel to Mále; where the pilot receives a fixed remuneration from the Hadégiri. On anchoring off the town of Mále, the Míru Baharu hails the pilot to inquire whether there be any sickness on board. Should there be none, he goes on board, when it is customary to present him with a piece of chintz or a shawl, and he then conducts the master of the vessel on shore. The port charges and duties are moderate. The sum of 40 rupees is payable by every foreign trading vessel, without reference to her size or to the period of her stay; but from a large vessel one candy weight of merchandise is exacted in addition. The only customs duty is a 10 per cent. charge on rice.

Besides, there is a duty consisting of 50 bags of rice, which is charged under the name of *hadiya*, or presents to the Sultan and officers of government; of this the Sultan receives five and a half bags of rice, with seven red handkerchiefs, to be carried to his palace at seven different periods, the bearers receiving back one handkerchief and a quantity of betel-nuts; the remainder of the *hadiya* goes to the officers of government and the Sultan's relatives, according to a list provided by the Hadégiri. These presents may be made either in rice, salt, cummin-seed, chilies, coriander-seed, which are taken by measure; or, in dates, catechu, turmeric,

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and onions, which are taken by weight, six gulls (gan) or one and half pounds in weight are equivalent to 6 bamboos, or 12 seers in measure. The Míru Baharu, who superintends this business, is entitled to a sixth part of everything given.

Besides, and on delivery of the above, 40 cotton handkerchiefs are required to be given, the cheapest of any colour being taken without objection. And then there is a small present of five rupees in a handkerchief, required to be sent to the Sultan, after the other presents are delivered, to obtain permission to barter.

Quarantine.—If there be small-pox on board, the vessel is put under the strictest quarantine for 40 days after the recovery of the person last affected. In case the disease was prevalent at the place from which the vessel comes, though there be no sickness on board, quarantine is nevertheless enforced, but the period is limited to what the Sultan may see fit to order.

Natural productions.—The cocoa-nut palm is most extensively planted; rows of them, with occasionally the aréca, line the roads; the nuts are esteemed superior to those of India, and, besides exporting vast numbers, the natives extract from the nut a kind of sugar termed hakuru; the tree grows to a height of 70 to 90 feet, but the banyan is the largest tree on the islands, attaining to a greater height than the palms. The nuts of the aréca palm are inferior to those of the continent. Screw-pines yield some fruit. Bread-fruit trees furnish a useful food. Almond trees, lime trees, plantains, papaws, pineapples, pomegranates, pumpkins, sugar-cane, sweet potatoes, and some other bulbous roots, are grown. Millet is grown to a small extent; but all the rice, which is the first article of vegetable food, is imported. On the southern atolls there is least cultivation but most rain.

Cotton is grown in small quantity at some of the islands in Miladummadulu atoll (*see* page 337). Mats are made of a grass on Suvadiva atoll, but not in great quantity. Cowri shells (the small money of the islands) are found in large quantities. Rats are numerous on the islands and destructive to the cocoa-nuts; tortoises, flying foxes, and crows are plentiful at Mále, also bitterns, and the usual sea-birds, curlews, &c.

Coral fish abound. The sword fish is common and sometimes found 18 feet in length. Turtle, sharks, and porpoises are plentiful, and from them oil is obtained. The bonito fishery is the chief employment of the islanders, that fish being the principal article of food as well as of commerce; sometimes a thousand are caught by one boat in a day, but 600 or 700 is the ordinary number.

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Climate.—The unhealthiness of the climate at the Maldives has long been notorious, and is doubtless the great obstacle to foreign intercourse and internal improvement. The cause of strangers losing their health is partly the lagoons and marshes throughout the islands, and partly the unvarying temperature of the atmosphere. When the East India Company's surveying vessels first visited the islands in 1834, the south-west monsoon had just cleared away, and the thermometer ranged between 80° and 82°. When the violent north-east monsoon showers set in, it fell as low as 75°, but rose only to 80°; and after that the range was between 82° and 85°, till after the middle of the year, when the south-west monsoon (blowing over the sea which had been so much reduced in temperature by the currents from southward of the line) again reduced it to 80° and 82°.

The sickness to which strangers are most liable is a bowel complaint—a species of *gastro-enteritis*—which appears peculiar to these islands; the only remedy seems to be an immediate departure for the continent of India. The natives also are liable to it, for in one instance nearly the whole population of an island was carried off. With the exception of beri-beri, which attacked the Indian lascars and not the European sailors, there are few other diseases of importance. Ague occurred to those of the surveying party who resided on shore. Amongst the islanders intermittent fever prevails and is difficult to be got rid of; all the British officers and men who remained on the island of Mále, during a part of the south-west monsoon, were prostrated by it and compelled to leave.

Language.—Three different kinds of written characters are found on Maldive tombstones. The most ancient is the Divehi akuru, which is written from left to right, and was probably used by the first inhabitants, but now the knowledge of it is very limited. The next is the Arabic character, written from right to left. The third, also written from the right hand and termed Gabuli tána, was introduced when the Portuguese garrison at Mále were overcome, and Mohammedanism re-established by a chief and some people from the northern atolls; it is now the common language throughout all the atolls. In consequence of the intercourse with traders from Bengal and other parts, the language now spoken at Mále is intermixed with many foreign words. The Gabuli tána alphabet has incorporated some auxiliary letters from the Arabic and Persian. Letters of the alphabet are used as numerals. The decimal and duodecimal notations are both in use.

Religion.—These islanders have a tradition that about 400 years ago the Mohammedan religion was introduced by a man from Persia, whose name, or that of the country from which he came, was Tabriz. Some time afterwards, Christians, doubtless Portuguese Roman Catholics, came

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there, and propagated the tenets of their faith, but they were soon expelled by a chief of Tiladummati atoll, who re-established Mohammedanism amongst them on a secure footing.

The tomb of Tabriz at Mále is held in great veneration, and kept in good repair. Shortly after his death some of his countrymen came in search of him, and remained and died at Mále; their graves are about sixty in number, but only two had legible Persian inscriptions, bearing date 994 of the Hijra, which would correspond with A.D. 1593.

Winds and Weather.—As the Maldives occupy a space of nearly eight degrees of latitude, and are partly south of the equator, it may be expected that their climate will be influenced on the one hand by the north-west monsoon, and on the other by those atmospheric disturbances which usher in the north-east monsoon of Hindustan and Ceylon. Therefore it is deemed necessary to give a separate description of the winds that are experienced at both north and south extremes of this long chain of islands.

Southern Maldives.—Addu atoll, being 40 miles southward of the equator, is almost without the influence of the regular Indian monsoons, the winds and weather being variable. The north-east monsoon is felt in January, February, and March, the winds generally from north and north-east, but occasionally from westward of north, and the weather is less cloudy and rainy than when the south-west monsoon prevails northward of the line. In April and May the winds are variable, but mostly from westward. From May to December the winds are from west to south and S.S.E., with much rain and squalls. About the middle of the latter month, which is about the time that the south-east trade finally retires southward, and the north-west monsoon commences south of the equator, hard squalls and fresh gales from West to W.N.W. with heavy showers of rain occur at Equatorial channel, lasting for several days.

Mále Atoll.—This central part of the Maldives marks a great difference in the weather during the north-east monsoon, for the southern groups then experience frequent squalls and rain with variable winds; whereas northward of Mále, that is the season (as at the Laccadives) of fine weather and generally moderate breezes. There is no such marked difference in the south-west monsoon.

Northern Maldives.—At Ihavandiffulu atoll, the head of the Maldives, the north-east monsoon is steady from the middle of December to the end of February, between N.N.E. and E.N.E., moderate and light breezes, with slight showers of rain occasionally. In March and April the winds incline more northerly and north-westerly, until in May the south-west monsoon commences, and lasts four months only. In

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September the winds are north-westerly, accompanied by westerly squalls and rain; in October the winds are moderate and variable from W.S.W. to North, when the weather is cool and pleasant, but occasional hard squalls occur with heavy showers of rain at about the same period as the Bombay *elephanta*. In November the winds are light between N.N.E. and N.N.W., with occasional easterly squalls; after the middle of the month there occurs a few days of dark cloudy tempestuous weather, with long continued rain from the westward; this seems to be at the same time as the change of monsoon in the gulf of Manar; after which the north-east monsoon is fairly established, and throughout December is steady at E.N.E., with pleasant and clear weather, but occasional squalls and rain from about E.S.E.

LACCADIVE ISLANDS.—This group, situated between the parallels of 10° and 14° N. lat., and between the meridians of 71° 40′ and 74° E. long., consists of fourteen islands, with a few detached reefs and banks. There are nine inhabited islands, two uninhabited, and three open reefs. The northern portion of the group is attached to the Collectorate of South Kanara, the remainder belong to Ali Rájá of Kannanur, and form part of the administrative district of Malabar. Each of these islands is situated on an extensive coral shoal, with an area of 2 to 3 square miles; no part of these formations rises more than 10 or 15 feet above the level of the sea; the outer edges are higher than the body of these shoals, and generally enclose a regularly formed lagoon in which the water is still even in the worst weather. The receding tide leaves the outer edge of the reef nearly dry, and the tide runs out of the lagoon by breaches in the edges, which are sufficiently large to admit the light native craft into the natural harbour.

Under the surface of these islands lies a stratum of coral from 12 to 18 inches deep; by breaking through this and removing the sand, fresh water may be obtained; this water rises and falls with the tide, and is said to be very wholesome. In some parts of these islands the soil is composed entirely of loose coral, a condition that is particularly well adapted to the growth of the cocoa-nut. The surface soil is naturally so barren that there is little or no spontaneous vegetation in most of the islands; and although during the monsoon some small crops of coarse dry grains are produced, their scantiness shows that the prosperity of the islands must depend on the cocoa-nut.

The island of Minikoi is an acquisition from the Sultan of the Maldives, and may be considered as part of that group.

History.—For two and a half centuries the Laccadive islands formed part of the small principality of Kannanur, having been conferred as "jager"

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on that family by the Cherakál Raja, about the year 1550. In 1786 the northern islanders revolted and transferred their allegiance to Mysore. In 1799, after Kanara fell to the East India Company, these islands were not restored to the Bibi of Kannanur, but a remission of revenue (525*l.*) was conceded instead. From 1855 to 1860 the southern islands were sequestrated for arrears of revenue; this again occurred in 1877, and they are now directly administered by the Collector of Malabar. In 1847 the group was devastated by a hurricane which destroyed over 1,000 people. The islanders are all Mussulmans, and, like the Moplas, of Hindu descent. A tradition is preserved among them that their forefathers formed part of an expedition from Malayála which set out for Mecca in search of their apostate King Bhasman Perumal, and was wrecked on these islands.

Customs and Language.—Monogamy is universal, and the women appear in public freely with their heads uncovered. In Minikoi they take the lead in almost everything except navigation.

The language of the Laccadive group is Malayálam, which is, however, written in the Arabic character; that of Minikoi is Mahl with a mixture of corrupted Malayálam. The head-men and pilots of most of the islands know a little Arabic; and the male inhabitants can generally read and write; they are bold seamen and expert boatbuilders.

Trade.—The chief and almost sole cultivation is that of the cocoa-nut palm; and the industry the preparation and exportation of coir (cocoa-nut fibre). The soaking of coir and the other processes connected therewith are conducted almost entirely by the women. The men convey the produce, which consists of coir, cocoa-nut, jaggery, copra, vendia, tortoiseshell and cowries to the mainland; those from the northern islands to Mangalore; and from the southern islands to the Malabar ports, Ceylon, the Maldives, and Calcutta. The annual value of the total exports is about 17,000*l.*

Medical aspects.—The climate of the Laccadive islands is healthy. Cholera has once visited Kalpeni, and formerly small-pox was the most dreaded disease of the islands. The practice, however, of both vaccination and inoculation has greatly reduced the mortality from this cause. Leprosy prevails, but the islanders have traditional sanitary laws, and are otherwise careful in their habits.

Winds and Weather.—The winds and weather in the vicinity of Minikoi island are much the same as at the head of the Maldive group, and differing little from those experienced in the northern islands and reefs of the Laccadives.

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At the commencement of the year the north-east monsoon is at its height, but, though steady, very light indeed, seldom attaining to a moderate breeze, unless the wind changes to the north or a little westward of it, when a fresh breeze may occur, for two or three days. Towards the end of February there remains very little easting in the wind. In March, it is usually north throughout the day, and north-west between sunset and sunrise, being strongest about midnight.

In the beginning of April, lightning is seen at night, and a few days' sharp squalls with rain occur in the evening or early night, from the south-east quarter, and sometimes from west, strong north-west winds succeeding them for three or four days; therefore April must be considered an unsettled month when a southerly gale, sometimes of a cyclonic character, may be expected along the Malabar coast. The *Cleopatra* cyclone of the middle of April, 1847, was felt among these islands, commencing at north-east, round by north to north-west, the vortex of the gale passing between them and the coast, but very close to the easternmost islands of the Laccadive group, over which the storm wave committed much havoc.

In the month of May the winds are mostly north-west, but occasional south-west breezes and a swell from that quarter herald the south-west monsoon, which is fairly established before the end of May and lasts till September, when the wind veers to the north-west, and during that month and October remains between north-west and North, and in November between N.N.W. and N.N.E. In this latter month southerly gales have been experienced at Bombay and along the Kanara coast, and north-east and south-east gales north-westward of the Laccadives; these atmospheric disturbances occur about the same period as the tempestuous weather at the head of the Maldives. For the first part of December the wind is tolerably steady at north, sometimes backing to N.N.W. and blowing fresh for two or three days; in the latter part it has more easting, and may be fairly called the north-east monsoon, at this time it has but little strength.

BAROMETER.*

Arabian sea and adjacent parts of Indian ocean.—January.—In the Arabian sea during this month, the barometer stands highest off the south-east coast of Arabia, about 30·15. From this region, atmospheric pressure decreases in all directions, and reaches its minimum (29·85) near the equator, about the meridian of 60° E. Across the

* Memoir on Winds and Monsoons of Arabian sea and North Indian ocean by Mr. W. L. Dallas, published at Calcutta, 1887.

See also the diagrams of Lines of Equal Pressure and Lines of Equal Temperature in "Wind and Current Atlas for Pacific, Indian Ocean, &c."

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middle of the Arabian sea from the gulf of Aden to within 200 and 300 miles of the west coast of Hindustan the readings are 30·00 to 30·05. To the south and west of Ceylon, including the northern part of the Maldive islands, there is an area of low pressure, within which the readings vary between 29·87 and 29·90, these readings are lower than in the neighbouring parts of the sea, and almost as low as in the equatorial region midway between Ceylon and the African coast. Along the west coast of Hindustan, and particularly in the northern part, the readings are low compared with places in the same latitude on the African and Arabian coasts. The isobars north of the parallel of 12° N. in the Arabian sea are anticyclonic and encircle the high pressure area off the Arabian coast, those south of this parallel are cyclonic and encircle the low pressure area of the equatorial region.

February.—As in the preceding month relatively low readings exist along the west coast of Hindustan, but the area of low pressure westward of Ceylon has disappeared, and the readings are uniform at about 29·90 throughout the south-eastern part of the Arabian sea and the adjacent part of the Indian ocean. There are two high-pressure areas existing this month, one overlying the entrance to the Persian gulf (mean reading about 30·11), the other extends from the meridian of 52° E. in latitude 14° N. in an E.N.E. direction as far as the meridian of 66° E. in latitude 18° N. (mean reading about 30·03), from this anticyclonic area, pressure decreases in all directions excepting to the northward, and the lowest reading (29·90) is found in a small area between the meridians of 60° and 70° E. and the parallels of 1° and 7° N.

March.—There is this month a general decrease of pressure throughout the northern part of the Arabian sea; at the entrance to the Persian gulf the fall amounts to 0·166 of an inch, and from the Arabian coast to the middle of the sea, about 0·100 of an inch. In the southern part of the sea, and in the equatorial region, the barometer is steady or rises slightly, so that very uniform pressures now exist throughout. The anticyclone off the south-east coast of Arabia, though less sharply defined than in February, is still fairly well marked, its central axis extending from about the meridian of 53° E. in latitude 15° N. in an E.N.E. direction as far as the meridian of 64° E. in latitude 18° N., from this axis the pressure decreases steadily but slowly in all directions, and reaches its minimum, 29·89, in a small area south of cape Comorin. The resulting gradient is very slight.

April.—The anticyclonic area has continued to move southward and now lies over the central parts of the Arabian sea, extending in an east and

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west direction from the African coast, almost as far as the peninsula of India. The highest mean barometer readings within the high pressure area lie along a line extending in an E.S.E. direction from latitude 15° N. on the meridian of 55° 30′ E., to latitude 13° N. on the meridian of 68° E. Along this axis the barometric means vary between 29·925 and 29·940, from which pressure decreases in all directions. Towards the north the decrease is moderate, the reading being 29·83 in latitude 22° N. To the southward the fall is slighter, and in the neighbourhood of the equator pressure rises again to 29·90, or even more, as far as latitude 3° or 4° N. Along the west coast of Hindustan the readings are still low compared with those in the same latitudes on the west side of the Arabian sea.

May.—There are still some indications of the anticyclonic area which has been such a prominent feature in the pressure distribution of previous months. In addition to the partial disappearance of this anticyclone, that portion of the high pressure in the eastern part of the equatorial region has also disappeared, and the readings (about 29·90) are now highest on the African coast. The reading (29·85), which in the preceding month was confined to the most northern regions, now commences about cape Guardafui, travels north-eastward to the meridian of 66° E. in latitude 19° N., thence in a south-easterly direction and passes round south of Ceylon. The 29·80 reading takes much the same course only on an average 3° to the northward of the former, while in the extreme north pressure decreases comparatively quick, and on the Baluchistán and Kathiawar coasts falls to about 29·70 inches.

June.—A decrease in the barometric pressure of about 0·1 of an inch takes place this month in the northern part of the Arabian sea, the isobars of 29·80 and 29·85 occupy positions approximately the same as in May. At the same time over the Indian ocean and the central regions of the Arabian sea there is an increase in the pressure since last month. Readings are highest (29·95) in the western part of the equatorial region, and decrease from this in all directions slowly towards the east, when a relatively high reading (29·90) extends over the equatorial region as far as the meridian of 74° E.; abnormally low readings exist between the African and Arabian coasts; there is also an elongated area of relatively low pressure (29·75 to 29·80) on the west coast of India.

July.—There is a decrease of barometric pressure this month throughout the Arabian sea and the adjacent part of the Indian ocean, considerable in the north, but slight in the south-west. The barometric difference between the equatorial region and the northern part of the Arabian sea has consequently increased, and now amounts to 0·479 of an inch. In other respects the distribution is similar to that of June, readings decreasing

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from a high pressure (29·95) in the western part of the equatorial region to a low pressure area (29·50) over Sind. The isobar 29·90 has extended considerably, and now stretches over almost the whole of the North Indian ocean. The elongated area of low pressure of last month on the west coast of India has disappeared, and the isobars now have a general east and west direction.

August.—The highest mean barometer (29·968) recorded in the month of August is in latitude 5° N. on the meridian of 55° E., and the lowest (29·650) on the Arabian coast. The steepest barometric gradient still lies over the western part of the Arabian sea, where in latitude 5° N. there is a mean reading of 29·933, and in latitude 12° N. of 29·726 inches, giving a difference of 0·207 of an inch in seven degrees of latitude.

September.—The barometric pressure this month continues to increase throughout the Arabian sea and North Indian ocean; the rise amounts to about 0·10 of an inch in the northern part, and 0·05 in the equatorial region. This change, which is analogous to that of last month, still further increases the tendency towards equilibrium between the north and south, this is exhibited to a far greater extent over the northern, central, and the eastern parts of the sea, than in the west. The barometric difference between the equator and the head of the Arabian sea has been reduced to 0·279 of an inch, and the intervals between the isobars have been proportionately increased. In the western part of the equatorial region the pressure has increased to 30·02, while the isobar of 29·95, which in previous months was confined to that part, now spreads eastward over the whole region.

October.—In the south-western part of the Arabian sea, and along the equatorial region, there is a high barometric pressure (exceeding 29·95), extending from the African coast as far as the meridian of 76° E., the northern limit of this pressure in the western part is latitude 10° N., and in the eastern part latitude 3° N. Off the south-east coast of Arabia there is a small area with equally high readings, but in all other parts of the sea the readings are below 29·95. At the entrance of the Persian gulf there is a small region in which the barometric pressure is below 29·90, off cape Comorin there is also a small area when the pressure is as low as 29·85 inches, but the main area of low pressure (29·90) extends over the Arabian sea, from the west coast of India to the meridian of 62° E.

November.—A considerable barometric rise occurs this month in the northern part of the Arabian sea, while in the southern and the equatorial region pressure is relatively steady. In the extreme north the rise amounts to about 0·2 of an inch, and has resulted in the formation of a well-marked area of high pressure off the Baluchistán coast, from which

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pressure decreases tolerably quick as far as the middle of the sea, when it becomes relatively uniform, the lowest reading (29·90) lies in a narrow area along the west coast of India and Ceylon. From this the main area of low pressure (29·95) extends to a considerable distance into the centre of the sea.

December.—In the northern part of the Arabian sea the distribution of pressure is practically identical with that of the preceding month. An area of high readings, 30·10 and above, overlies Baluchistán, and extends southward to some distance over the neighbouring sea. From this region readings steadily decrease and reach their minimum (29·90) within a small area stretching from the coast of Ceylon across the Maldives, and as far west as the meridian of 68° E. The readings throughout the sea, though slightly higher, are uniformly low, and the deepest gradient lies over the centre between latitude 12° and 20° N. Between Sokotra and Arabia there is a small area of high pressure (30·05). The general conditions of the pressure during this month are similar in most respects, not only to those of the preceding, but also to those of the succeeding month.

WINDS AND WEATHER.*

MONSOONS.—The North-East Monsoon, or fair weather season, generally commences about the middle of November at Bombay and on the northern parts of the coast; and in October southward of mount Dilli, about Calicut, Cochin, and Anjengo. At the observatory of Dadabetta on the Nilgiri hills, 8,600 feet above the sea, the winds are north-west during the first part of September, veering to north-east before the end of the month; increasing in force in October and November, and very strong in December. The strong south-west and westerly winds off the Konkan coast, fail after the middle of September, and are followed by light variable breezes, frequent calms, cloudy weather, and showers at times. This unsettled state of the weather, between the monsoons, generally begins late in September, and continues six or eight weeks; the prevailing winds are from north-west, but at times from south-west, and southward; squalls occur occasionally, blowing from the land, although these are seldom experienced in September or October, except on the Kanara, Malabar, and Travancore coasts.

At the breaking up of the south-west monsoon there is frequently thunder and lightning; attended at times with a sudden storm from southward, which veers to south-west, but generally to south-east, blowing very hard for several hours. This generally occurs late in October or early in November, after which the north-east monsoon sets in, with fine

* *See* Admiralty Wind and Current Atlas.

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weather, when land and sea breezes are experienced within 10 or 20 miles of the coast.

The navigation northwards during October and a great part of November is usually tedious and uncertain, for there is no dependence on the winds till late in November; but the light winds are not unfavourable for sailing down the coast, and the drain of current to southward, fed by the freshets of the many rivers, aids a vessel's progress considerably. In December, January, and February the land and sea breezes are regular (*see* page 49), the sea is smooth and the sky clear.

In the gulf of Manar the north-east monsoon commences with force about the middle of November, and lasts till the end of January. It blows steadily from N.N.E. along the Indian shore, but on the opposite coast, the north-west part of Ceylon, it is modified into land and sea breezes, with very fine weather. In February land and sea breezes commence on the Indian side; and by April the general direction of the wind in the gulf will be found to have drawn round to southward; the sea breezes being from south-east to south-west, according to the coast on which they prevail. These sea winds of Manar now become of longer duration and increase in force till about the middle of May, when the regular south-west monsoon sets in on the Ceylon coast, anticipating by a few days that of the Indian coast.

The South-west Monsoon on the west coast of Hindustan may be said to prevail for the five months of summer, and the north-east monsoon for the five winter months, an interval of storms and calms occurring, in both cases, at the period of change. It is usually held that this change takes place about a week after the passage of the sun northward or southward over the parallel of the place; and that the rains, which always accompany it, follow or retire a few days afterwards. Thus, on the north coast of India, the period of the rainy season is of limited duration compared with that of Malabar.

From the beginning of November to the end of May the sky has been cloudless, comparatively speaking, and not a shower has fallen. Large clouds now begin to make their appearance daily, at noon, over the mountains; and, advancing from eastward, against the wind then blowing, exhibit a display, first of sheet, afterwards of forked lightning, which after dark disappears. This continues for a week or more, when the lightning is more vivid every evening. Until the rains fall, the clouds invariably disappear immediately after dark; and, though the sun may have gone down amid signs of coming tempest, the sky is cloudless a few hours after.

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Suddenly, after perhaps a week as above, a little after sunset, there is a blast of wind from the clouds in the east, followed by heavy rain with thunder and lightning. This generally lasts from one to two hours, when the wind veers round to south-west, blowing with increasing steadiness and diminished force, and the thunder is only heard in the distance.

The first burst of the south-west monsoon on the west coast of Hindustan occurs about the end of May or beginning of June, and seldom lasts more than a night and part of a day; and, on the second dawn, the burnt and parched earth seems washed and refreshed. The rays of the sun are no longer fierce as they were a week before. After a few days of this weather, during which the south-west wind is strongest in the afternoon as a sea breeze, the sky becomes more overcast, and continuous squalls from the south-west quarter announce that the monsoon has fairly set in; the heavy rains return, and continue for forty or fifty days with an occasional interval of a few days fine weather.

It has been observed at Bombay that the first stormy weather of the south-west monsoon seldom appears with the full moon, but generally during the dark nights. Although southerly winds prevail greatly after the middle of May, the stormy weather and rain usually do not set in until the beginning or middle of June. From the first week of June to the 15th or 20th of July the weather is generally most unsettled; hard squalls, much rain, and dark cloudy weather may then be expected in the vicinity of Bombay harbour.

The rains at Bombay slacken off early in August; and the natives, on the first full moon of that month, celebrate the departure of the monsoon, on what is called Cocoa-nut day. The boldest then put to sea; and all their vessels, which have been laid up and hutted in since the end of May, are prepared for service.

After some weeks of mostly fine weather but frequent showers, the coast beneath the Western Ghats (called in general the Malabar coast) is usually visited in the end of September, or the beginning of October, by strong easterly squalls, with rain and thunder; this is termed the Elephanta, which finally closes the rainy season.

The description of the setting in of the south-west monsoon at Bombay will serve for the whole coast of Konkan and Kanara; but in Malabar, south of Palghat gap, the peninsula becomes narrower, and altered conditions cause a difference in the manner and time of the monsoon's approach. In Travancore it commences earlier than on the Konkan coast, the difference being frequently fifteen or twenty days between cape Comorin and Bombay. The fair weather sets in proportionately sooner to southward, where vessels may anchor in September, or even

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in August, in safety, if care be taken to lie well out, ready to proceed to sea on the appearance of a gale, though a severe one seldom happens in these months on the coast southward of mount Dilli, the wind being then much from north-west.

Late in May the south-west monsoon usually sets in on the southern part of the coast, frequently commencing with a gale from south-east, veering to south and south-west, where it ultimately remains; at other times it commences with squalls from south-west, and a heavy long swell rolling in upon the shore. In June, after the monsoon has set in, the wind keeps mostly between South-west and W. by S., with severe squalls at times, much rain and a high sea. In July, the weather is nearly the same, becoming a little more settled as the month advances; the squalls veering sometimes to West and W.N.W. The sky is mostly obscured by heavy clouds during these months, but considerable intervals of fine weather are occasionally experienced. Vessels have left Bombay harbour so late as the 6th or 8th of June, and, with fine weather, passed down the coast without making a tack, steady breezes prevailing at W.S.W. and West; but such favourable seasons are seldom experienced.

Westward of all the islands the breezes of the south-west monsoon are strong and steady, while towards the coast of Hindustan they are variable in direction and blow in squalls. It has been remarked that almost all the rain squalls of the Malabar coast, at about 200 miles from land, come from northward of west; they have been experienced from north-west at a greater distance than 100 miles west of the Konkan coast, in the end of July; and off the Malabar and Travancore coasts, in the beginning of that month, during the night or early morning.

In August the monsoon does not blow so strong as in the preceding months; the squalls then veer to West and W.N.W., particularly on the southern part of the coast. North-west and W.N.W. winds are those which prevail in this month near Anjengo and cape Comorin.

In September the weather moderates, westerly and W.N.W. winds are the most prevalent in this month, and the squalls are seldom severe, although the weather is often cloudy and threatening, with heavy showers. A swell often rolls in from W.S.W. in this month, particularly during unsettled squally weather.

At Trivandrum (only 3 miles from the sea-coast) and at Dadabetta (on the highest peak of the Nilghiri hills) it was found that the wind blows from south-west for a few days only at the commencement of the monsoon; it soon veers more westerly, and by the middle of August is fairly north-west. At the last-named mountain top the wind becomes north-east in the latter part of September, or sometimes very early in October.

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In the gulf of Manar the south-west monsoon sets in at the middle of May, and is attended with heavy rain, thunder and lightning, particularly along the Ceylon shore, where the wind blows on to the land. Along the Tinnevelli coast it has more the character of an along-shore south-west wind, and loses most of its moisture by the interposing Travancore Ghats; thus on the Indian shore of the gulf of Manar the rainy season does not commence until the end of October or beginning of November, while Ceylon has its greatest rainfall in May, and another, though rather less copious, fall in October and November, the intermediate months being also rainy.

June is the month of the south-west monsoon's greatest force in the gulf of Manar; in August the strength of the wind abates, but southerly winds are still experienced at the Manar end in this and the following month, becoming lighter as the season advances. Variable and gentle breezes, with smooth water, may be usually expected in October, lasting till the setting in of the north-east monsoon, in the end of that month or beginning of November, by two or nearly three weeks of heavy rain; this is termed the Madras monsoon.

WINDS IN THE ARABIAN SEA.*

January.—During this month the north-east monsoon is the predominant wind over the Arabian sea, it does not, however, prevail uninterruptedly in all parts. Off the south-east coast of Arabia eastward of the Khorya Morya islands, south-easterly winds blowing directly on to the shore, prevail very generally, with occasional breezes from the west and north-east, these winds extend about 100 miles seaward. Along the west coast of Hindustan the prevailing direction of the wind is northerly. Off the coasts of Sind and Kathiawar, and past the entrance to the gulf of Cambay, the wind varies from all points between west, north, and east, without any predominant direction; in lat. 18° N., however, the westing disappears, and the prevailing wind is more northerly, till it reaches the Laccadive islands, where it becomes merged in the general north-east monsoon. In the equatorial region south of cape Comorin, the wind is more from the northward; and to the southward of Ceylon there is a slight westerly inclination, due to the low pressure area that exists in this part during January. Between the African and Arabian coasts the wind is rather more easterly than northerly. With these exceptions the wind over the Arabian sea is very steady from north-east.

The wind varies considerably in strength over different parts of the sea, it is strongest over the central and south-western parts. Along

* *See* Admiralty Wind and Current Atlas.

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the south-east coast of Arabia; in the northern part of the sea, and along the coast of Hindustan the winds are light.

Calms are rare over the central part of the Arabian sea, but around the coasts and in the equatorial region they are not uncommon.

February.—The general movements of the winds this month are similar to those of January. In the northern part of the sea north-westerly and north-easterly winds are experienced, the former extends down the Indian coast past Sind, Guzerat, and the gulf of Cambay; the latter crosses the mouth of the Persian gulf, and travels down the south-east coast of Arabia. The south-east wind of the preceding month in the neighbourhood of the Khorya Morya islands has now disappeared, and the winds on the mid-Arabian coast are variable and light. The north-east monsoon is steadiest and strongest in the middle of the sea; its direction is more easterly near the African and Arabian coasts; along the west coast of Hindustan northerly winds prevail as far as cape Comorin. In the south-east part of the sea northerly squalls occur occasionally. Calms are frequent along the west coast of India, round cape Comorin, and off Ceylon.

March.—In the entrance of the Persian gulf and over the northern part of the Arabian sea, the wind is generally north-westerly, and along the west coast of Hindustan this direction is maintained more or less as far as cape Comorin; over the central part of the sea, the north-east monsoon is almost as general and steady as in the two preceding months. In the equatorial region south of the peninsula of India the wind varies from south-west to north-east, with a slight maximum at north, while in the mid-equatorial region it varies from north-west through north, to south-east, with a slight maximum at north-east. In the western equatorial region the north-east monsoon prevails as steadily as over the central part of the Arabian sea; between Africa and Arabia the prevailing wind is easterly, veering occasionally to the south-east and north east. In the lower part of the Persian gulf, along the Baluchistán and Sind coast, also on the south-east coast of Arabia, north-westerly squalls of considerable strength will be experienced occasionally, but the force of the wind generally throughout the sea is less than in February. During this month calms are frequent along the anticyclonic axis, off the south-east coast of Arabia, also in the south-east part of the sea.

April.—The axis of the anticyclone or line of highest mean barometer, mentioned in page 34, forms apparently a dividing line in the wind system of this month. Along this axis frequent calms and light airs are experienced; but to the northward the prevailing winds are from the

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westward, and to the southward the direction is more from the eastward. Between latitude 10° N. and the equator, westward of the meridian of 65° E., the general direction is strong north-easterly. Along the west coast of Hindustan the prevailing winds are north and north-west, but south of the parallel of 6° N., the northing disappears; and from cape Comorin to the equator, although the wind is variable, the predominant direction is from the west. In the mid-equatorial region the wind is very variable.

During this month south-westerly winds are generally stronger, and north-westerly winds lighter than in March, but the mean force throughout the sea may be considered practically the same.

May.—The strong north-easterly winds that prevail in the south-west part of the sea during April almost disappear this month, and the winds are now strong between south and west, forming the commencement of the south-west or summer monsoon. In the western and northern parts of the sea, and in the equatorial region, the predominant wind is south-westerly to westerly; while off the west coast of Hindustan the wind is generally north-westerly as far south as cape Comorin, when the direction changes to west, and at times south-west. The force of the wind throughout the sea is a little stronger than in the last month, and calms are not so frequent.

June.—The south-west monsoon is now the predominating wind throughout the Arabian sea and northern part of the Indian ocean; departures from this general direction occur in some parts of the sea, they are, however, so slight as to be almost unnoticeable in the prevalence of the more important wind. This monsoon crosses the equatorial region from a southerly and south-westerly direction, but over the centre and in the northern part of the sea the prevailing direction is strongly south-west. Along the African coast the predominant wind remains at south-south-west; in the eastern part of the sea and along the west coast of Hindustan the wind varies between south-west and north-west, with a slight maxima at west-south-west. South of cape Comorin the wind is variable between the two western quadrants, while in the neighbourhood of the Maldives the predominant wind is westerly. Between the African and Arabian coasts and in the mid-equatorial region south-easterly winds are not uncommon during this month. On an average the winds are stronger than during last month, but in the eastern part of the equatorial region the wind is not so strong as in the other parts of the Arabian sea. Throughout the whole of the western equatorial region, and from that north-eastward over the central part of the sea, calms never occur during this month; but

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in the neighbourhood of Sokotra, along the west coast of India and in the eastern equatorial region, calms and light variable winds are occasionally experienced.

July.—The south-west monsoon continues to blow with unabated strength and prevalence throughout the sea during this month. On the western side, owing to the influence exercised by the low pressure, there is very little veering, and the wind blows from a more southerly direction from the equatorial region, past cape Guardafui and on to the Arabian coast; in all other parts the wind veers more to the south-west after passing the equator. On the eastern side of the equatorial region the change is rapid, a westerly wind is developed almost immediately north of the equator and continues in this direction past Ceylon. In other parts of the sea the veering is more gradual, and on approaching the west coast of Hindustan becomes more westerly. Along this coast the prevailing direction of the wind gradually changes on proceeding southward; on the Kutch and Kathiawar coasts south-westerly winds prevail; in the latitude of Bombay the predominant direction is west-south-west; between the parallels of 16° and 10° N. the wind becomes more westerly, and southward of the latter parallel there is a considerable per-centage of north-westerly winds. During this month the force of the wind reaches its annual maximum, though the excess over the preceding and succeeding months is small; the strongest winds are those from south-south-east, south-west, and west-south-west. In the entrance of the gulf separating Africa from Arabia there are numerous calms and variable winds, this part being sheltered from the force of the monsoon by cape Guardafui.

August.—Though the monsoon is somewhat weaker this month the direction of the winds are similar in nearly every respect to those of the preceding month. Along the equatorial region there is a large per-centage of south-easterly and south-westerly winds, and eastward of the meridian of 60° E. in this region, westerly and north-westerly winds are frequently experienced. In the western part of the Arabian sea, the monsoon, after passing the equatorial region, continues its progress past cape Guardafui and Sokotra to the south-east coast of Arabia, and the extreme north of the Arabian sea, but in the middle and the eastern part of the sea, northward of the parallel of 4° N., the wind veers rapidly to the west, and the predominant direction over these parts lies between west-south-west and west-north-west. On approaching the coast of India a further inclination to veer is developed, and during August the prevailing winds along this coast are between west and north-west. The force is rather less than that of July, and the strongest winds will be experienced in the west and middle parts of the sea, between the parallels of 6° and 16° N. Calms are not so

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frequent as in last month, the principal regions in which they occur are the entrance to the Persian gulf, the strait between Africa and Arabia, and that part of the sea just east of the Laccadives and Maldives.

September.—The south-west monsoon still prevails steadily over the Arabian sea, though in most parts with less force. In the mid-equatorial region the winds are less steady than they were during the months of June, July, and August; and in the eastern part westerly winds are more prevalent. About Cape Guardafui the wind is not so steady as it is off the African coast to the southward; south-easterly, easterly, and north-easterly winds are not infrequent at this time. In the Persian gulf the wind is very irregular, but with a slight preponderance from the westward. In the eastern part of the sea the winds are generally from the north-west and west veering at times, to north. From cape Comorin to the equator the general direction is westerly. The average force of the wind is decreasing; the strongest winds during this month will be experienced in the western part of the sea between the parallels of 6° and 14° N.; and south of Cape Comorin and Ceylon. Calms are frequent in the gulf of Aden, off the south-east coast of Arabia, and in the Persian gulf. In the eastern part of the sea they are not so frequent, and in the middle and south-west parts calms do not occur during this month.

October.—Northward of the parallel of 10° N. in the middle of the sea the north-east monsoon blows uninterruptedly; southward of this parallel the wind is equally steady from a westerly and north-westerly direction between the meridians of 60° and 80° E.; westward of 60° E. south-westerly winds are experienced at this time. Along the west coast of Hindustan the predominant wind is from north-north-west. On the coast of Arabia the winds are variable and are apparently land and sea breezes. About Sokotra and between Africa and Arabia there is a steady easterly wind. The force of the wind in this month is less than at any other during the year, with the exceptions of March and April. Calms are frequent off the south-east coast of Arabia; between Africa and Arabia; south-east of Sokotra; and west of the Laccadives and Maldives, but along the west coast of Hindustan they occur only occasionally.

November.—Between the equator and the parallel of 6° N. the wind is variable, but the predominant wind is from the north-west. Along the west coast of Hindustan, as well as over the sea westward of Ceylon, the direction of the wind varies considerably, though in most parts there is a slight excess of northerly and north-westerly winds. In all other parts of the sea the north-east monsoon prevails. The general force of the wind is slightly more than in October, the average force is stronger in the western than in the eastern part of the sea, but the greatest force will be

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experienced in the neighbourhood of Sokotra. Over the middle of the sea calms are seldom encountered, but near the coasts and in the eastern part of the equatorial region they are fairly frequent.

December.—The winds over the Arabian sea are much steadier than in November, the north-east monsoon prevailing over the greater part. In the Persian gulf the principal direction is from north-west; off the Baluchistán coast, within the high-pressure area, the wind is very variable, but over the northern part of the sea the general direction is from the northward, though with a considerable amount of north-easterly winds. Along the west coast of Hindustan the principal direction is from the north. In the equatorial region winds from south-west and west occasionally occur, and off the south-east coast of Arabia south-easterly winds are frequent. The average force for all parts of the sea is slightly more than in November, and as a rule winds from a northerly direction are stronger than those from the southward. Calms seldom or never occur over the middle and south-west part of the sea, where the north-east monsoon blows most uninterruptedly, but they are fairly frequent over the north and south-east parts of the sea.

Having described the monsoons of Bombay, Malabar, and the coast southwards to the Indian shore of the gulf of Manar, a description will be given of the winds and weather experienced in the gulf of Cambay; and on the Kathiawar and Sind coasts, where the disturbing influence of the lofty mountain chain of the Western Ghats is not felt.

WEATHER.

Gulf of Cambay.—The fair season in the gulf of Cambay is from October to May, and during the first four months the weather is generally very fine but with an occasional fresh breeze from the north-eastward, which, with the strong tides, causes a chopping sea off Gogha; during the night, on the Kathiawar side of the gulf, the wind is generally from the westward or north-westward, but this is often very local, and at 3 or 4 miles from the coast a light north-easterly breeze may be found. In February there is more wind, and fresh breezes from the north-eastward are more frequent. In March the weather becomes rather unsettled and the wind more changeable; during the latter part of this month fresh southerly and south-easterly breezes are frequent, and the weather at times thick and foggy. In April and May the sea breezes are from the southward on the Kathiawar side of the gulf, and from south-east on the coast between Goapnath and Piram island; during these months the southerly and south-westerly winds blow fresh occasionally, and the weather remains very unsettled until the monsoon breaks. The coasting steam vessels and native craft do not put to sea after the middle of May, and from that time till September there is no traffic in the gulf.

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Gulf of Kutch.—In the Gulf of Kutch westerly and south-west winds prevail from February to October inclusive, and north-easters in November, December, and January.

In the latter month it occasionally blows fresh, but never for more than two or three days at a time, followed by light winds and calms, or light sea breezes in the afternoon. The barometer rises with these strong north-easters, and falls before westerly sea-breezes.

In the latter end of the month of January and beginning of February dense banks of fog are frequently seen at early dawn on the horizon, after a calm night; when the sun rises, these drift to sea with the land winds, and are blown back with westerly winds, obscuring all objects. They generally come in heavily detached masses, wetting everything, and almost obscuring the sun, which, however, shines out with apparently greater warmth during the intervals. These fogs may be expected until the latter end of February, and are invariably wet. The same prevail on the coast of Sind at that season over the swamps of the Indus.

From the first week of February fresh breezes from west to south-west may be expected; these are indicated by a slight fall in the barometer, and last for two days, succeeded by calms or light winds. And although north-easters may still blow occasionally after this date, it is but seldom, and only as a land wind, in the morning, or after midnight; and a slight rise in the barometer precedes them.

After the beginning of March the westerly winds may be said to have fully set in; and now calms and light north-east winds are of only occasional occurrence. Towards the vernal equinox, or some time in the second or third week of March, there are one or two days in which thunder and hailstones happen at the head of the gulf, in heavy squalls from south-east to north-east. The barometer gives no warning of these.

In April westerly and W.S.W. winds prevail, being strongest in the afternoon as a sea breeze, and moderate from midnight till the next forenoon.

From the beginning of May the heavy south-west monsoon swell has commenced at the entrance of the gulf, and it becomes a difficult matter to work round the north-west point of Okhamandal from Beit to Dwarka, even with the strong ebb tides that prevail in that locality; for the swell on Gurur shoal is heavy and confused. Only the larger sort of Kutch kótias attempt it after the middle of May, and they have to lie inside Beit and take advantage of any break in the strength of the wind to get out.

From June till the end of August the south-west monsoon blows with more or less strength, sometimes amounting to a fresh gale. Heavy rain seldom occurs before the middle of July, and sometimes later, though after the end of June frequent showers happen. After the middle of August

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the most enterprising of the Kutch boatmen leave Mandvi, and lie at Beit, looking out for a break in the weather, which they take advantage of, and make the passage to Bombay in three or four days. The first arrivals at Mandvi from Bombay after the south-west monsoon are in the first week of September. After the middle of that month the winds get considerably weaker, and haul to about W.N.W. towards midnight. But not until October, when they haul more to northward and become decided land winds, can a vessel fetch out of the gulf from Mandvi on one tack without going to Beit.

In the beginning of November, land winds, or north-easters, may be looked for with certainty, and frequently are of moderate strength. After the middle of the month they blow fresh occasionally, sometimes lasting all day; but when the forenoon is calm, the sea breeze may be looked for soon after mid-day. The sea breezes off the Kutch coast are a great relief after the dry land wind. On the Hallar coast the north-easters are pleasant.

Coasts of Kathiawar and Sind.—January.—Winds continue much the same as in December; sea breezes veering more to the south-west. Squally weather with rain sometimes occurs near Karachi.

February.—Winds become more variable, the lands winds less frequent and of short duration; sea breezes between W.S.W. and W.N.W., and towards the end of the month there may be a hard blow from the westward for two or three days, particularly on the northern part of the coast.

March.—Land winds become less regular; sea breezes are more durable and generally moderate between west and north-west, but blow very hard at times, with thick misty weather.

April.—Winds much the same as last month, weather generally hazy, with a very damp atmosphere. Swell from westward at times.

May.—Winds moderate from West to W.S.W., weather hazy, with very heavy dews. Clouds begin to gather and much swell prevails from westward at times.

June, July, and August.—The south-west monsoon prevails, blowing moderate and fresh between west and south-west, with passing clouds, and hazy weather. It becomes very cloudy as the season advances; rain is uncertain, but may be expected about the latter part of July, and is generally accompanied by variable winds and thunderstorms. A heavy swell prevails during the month of July.

September.—Winds light from west to south-west; squalls from the land may be expected. The weather is generally hazy, and the monsoon swell not yet subsided.

October.—Winds west to north-west, light with occasional calms. Land winds get steady about the latter end of the month. Weather generally

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very clear and pleasant, but sometimes dense fogs come off the land. Sea smooth.

November.—Land and sea breezes become steady, veering between west and north-west; the land winds, towards the end of this month, being from one to two days' duration, but not very fresh. Weather generally very clear, and objects visible at a great distance. Mirage frequently occurs during this and the following months.

December.—Steady land and sea breezes between N.N.W. and North-east. The north-easters on the coasts of Sind and Kutch now blow strong for three or four days at a time, but with less force and shorter duration than on the Kathiawar coast. Southerly winds are rare; but when they occur it is generally after a strong north-easter, when they are very light. The weather is now cool and pleasant, with a clear atmosphere.

FOGS.—On the coasts of Sind and Kutch, and in the latter gulf, dense banks of fog occasionally come off the land in October, January, and February, after a calm night; they drift seaward with the land winds, and return with the sea breezes, until the heat of the day disperses them. In some parts, on the west coast south of Bombay, there are similar fogs in October, but in a much less degree; these only obscure the low land and projecting headlands about sunrise, and a little after. The Western Ghats are enveloped by dense mists, or haze, from April to November, these, however, disperse occasionally for short intervals after heavy falls of rain; in the south-west monsoon the atmosphere is so dense as to obscure the mountains from view.

In the season of north-west winds off Bombay, and along the coast southward, the atmosphere is generally hazy, particularly in March and April; and, through this haze, the land and trees along the coast appear to be at a much less distance than they really are. This is especially the case during the south-west monsoon.

LAND AND SEA BREEZES.

The limits of the season in which these are experienced are from the autumnal to the vernal equinox, but owing to the mountains along the western coast of Hindustan, the strength and duration of the land winds depend much upon the configuration of the land. The land wind of the gulf of Manar and of the Malabar coast is only the north-east monsoon of the bay of Bengal, similarly as the land wind of the Coromandel coast is a prolongation of the Malabar south-west monsoon.

The sea breezes of the Malabar coast are fairly established throughout October (while as yet the land winds are only occasional, light, and

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uncertain), and they seldom fail, except in the peculiar localities already noticed, till they are merged in the south-west monsoon. Thus the navigator may calculate on sea breezes for eight months of the year, but on regular land winds for only half that period. It is the sea breeze that makes the climate of the west coast so pleasant during the fine season.

On the west coast of Ceylon land and sea breezes occur in December and January, as on the Malabar coast; but the winds along the Indian shore of the gulf of Manar do not assume the character of land and sea breezes until February; from the middle of November till that month they are N.N.E. to North-east. In February, when Madras has the sea breeze in the afternoons from south-east to south (the "along-shore winds"), the Tuticorin coast has the same, but blowing directly on to the shore. By April the general direction of the wind, in the northern part of this gulf, has drawn round to southward, the sea breezes being from south-east on the Indian shore, and from the south-west along the northern Ceylon shore, but north-west between Colombo and Point de Galle, as they are then north-west along the whole Malabar coast.

Where there are gaps in the mountain chain, as at Palghat, on the south of the Nilghiri hills, the land winds in December and January continue sometimes to blow for more than a day without any intervening sea breeze. This occurs, also, but in a rather less degree, off Karwar head, where the valley of Sadashivgad river assumes a straight funnel-shape eastward, towards the interior table-land.

In these months a sailing passage may sometimes be made from cape Comorin to Bombay in six to eight days, and the return voyage in four or five days. In November and early in December the sea breezes are weak, but become stronger afterwards. As February advances, the land breezes decrease in strength and duration, and are not always regular.

When the land and sea breezes are regular, the sea breeze fails in the evening about sunset, and is generally followed by a calm, which continues until the land wind comes off; this may be expected to commence at from 8 h. to 10 h. p.m.; at first, it comes in fluctuating gentle breezes, but soon becomes steady between North-east and E.S.E., continuing so till 9 h. or 10 h. next morning; it then begins to fail, decreasing to a calm about mid-day. About this time, or soon after, the sea breeze sets in from W.S.W., West, or North-west, a pleasant refreshing wind, and generally veers to northward in the evening, decreasing in strength.

In March and April, off the coast of the Bombay presidency, the land breezes are very light and uncertain, seldom coming off till morning, and continuing so short a time that little advantage is gained by them; it is therefore necessary to keep an offing, to be ready for the sea breeze, which

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may at this time, between Bombay and cape Comorin, be termed north-west winds, for they usually set in about noon at W. by N., or W.N.W., veering gradually to N.W. and N.N.W., in the evening, where they continue during the first part of the night, declining afterwards to a calm about midnight, or early in the morning. A faint land breeze sometimes follows; but more frequently light airs from northward or calms may be expected, nearly from midnight until the north-west wind sets in about noon on the following day. These north-west winds, at the full and change of the moon more particularly, blow strong, producing a short chopping sea and a drain of lee current, making it necessary to anchor at times with a light anchor, when it falls calm, to prevent being driven southward.

In April the weather is mostly hazy, and at times cloudy over the Ghats in the evenings, with light showers. During this month the sea breezes on the coast of Kathiawar eastward of Jáfarábád blow from about S.S.E., at Diu, S.S.W., and along the west coast, W.S.W.

In May the prevailing winds along the coast south of Bombay are from north-west and west, but often variable and uncertain, with cloudy threatening weather and light showers at times, accompanied by lightning from south-eastward. A gale from south-west or southward is liable to occur in this month, and several ships have speedily run along the coast to Bombay; but it is prudent to keep well out from the land, and to be prepared for bad weather, in order to avoid being driven on a lee shore if a storm should set in from westward. When north-west winds prevail, the weather is settled and clear of clouds, though a little hazy; but it is cloudy and threatening when they blow between south-east and south-west. It sometimes happens that heavy clouds collect over the land in the evenings, producing a hard squall from it with rain about midnight; this has frequently been experienced between Mangalore and Hog island, both in May and early in June, when these land squalls blow in sudden gusts through the gaps between the mountains.

During the period of change, before the south-west monsoon has set in, the small coasters run, in the afternoon, into the nearest river or place of shelter south of Bombay, but large vessels should have sea-room.

In the gulf of Kutch, and off the Sind coast, the land winds, in January, sometimes blow for forty hours, merely relaxing in force at the hours when a sea breeze is due, and being strongest in the morning two or three hours after sunrise, when the land winds are usually strongest. At such times as these continuous land winds blow, the parching dryness of the atmosphere is most trying.

These land and sea breezes require attention to benefit by them to the full extent. During the night, with the land breeze, it is prudent to keep

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well in shore, if the wind admit, without tacking, for there it is stronger and steadier than farther out; but in the morning it is advisable to edge more out, to get an offing of 15 or 20 miles, or soundings of 26 or 30 fathoms, before noon, ready for the sea breeze. In the evening, it is desirable to be near the shore, before the land breeze comes off; the coast may be approached to a depth of 10 fathoms in most places from Bombay to Quilon, and if close in, prior to the commencement of the land breeze, short tacks should be made near the shore until it comes off; when calm, its approach is frequently indicated by the noise of the surf on the beach, which is heard at a considerable distance.

CEYLON. — Winds and Weather.*— January. — The north-east monsoon is at its height; its general effects are parching by day, dry and cutting at night, when it is considered injurious to health. The winds between Galle and Colombo are from N.N.W. to N.N.E.; squalls at times from the eastward, weather generally fine and clear. Between Colombo and Pamban the prevailing winds are from north to north-east, moderate in the morning, stronger in the afternoon, weather generally fine. At Pamban, the north-east wind is light in the morning, but sets in strong about noon as a sea breeze, falling again at sunset.

February is dry and hot by day, but the nights are cool. Between Galle and Colombo, at the beginning of the month light north-east breezes and cloudy, but at the end the wind is variable with occasional showers at night when the land breeze is blowing. Between Colombo and Pamban the prevailing wind is N.N.E. blowing fresh with clear weather. At Pamban the weather is about the same as in January.

March is close, hot, and sultry, with dark clouds over the land. Between Galle and Colombo the winds are unsteady with hazy weather. Between Colombo and Pamban moderate north and north-east winds; and fine weather with passing showers. March is one of the finest months at Pamban, the north-east wind being light and variable; occasionally south and south-west winds blow for a day or two.

April is an oppressive month, the mean temperature by day being about 88°; towards its end a ground-swell from westward proclaims that the south-west monsoon is not far distant. The wind is light and variable, with calms, and light showers at night; squalls of wind and rain occur, and occasionally the south-west monsoon sets in before the month terminates.

May.—The sky gradually becomes more overcast, banks of clouds rising over the ocean; about the middle of the month the south-west monsoon commences, usually with a burst of rain for a few hours, a clear

* *See* Admiralty Wind and Current Atlas.

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sky supervening. After this event the winds between Colombo and Pamban are mostly south-west; a gale sometimes sets in commencing at South and ending about W.S.W.

In **June** the south-west monsoon gains considerable strength, and between Galle and Colombo varies from S.W. to W.S.W.; there are frequent showers, and the temperature is much reduced. The fishermen seldom go to sea in June.

July is more moderate on the west coast of Ceylon, and showers are less frequent. Between Galle and Colombo the prevailing winds are from West and W.S.W., moderate during the night, light in the mornings and strong in the afternoon, with occasional squalls. It is hazy and cloudy over the land, especially in the early morning. There are generally fresh breezes and cloudy, hazy, weather during this month in the gulf of Manar; the wind moderates near the head of the gulf in the morning, but blows strong again in the afternoon.

August is a fine month, with fresh winds from S.W. to W.S.W., veering at times to W.N.W. between Galle and Colombo; the afternoon breeze is the stronger with occasional squalls and rain. The nights are invariably clear and cool.

In **September**, on the south coast of Ceylon, fresh W.S.W. winds prevail with hazy weather, and off Point de Galle it is generally cloudy and squally. Between Colombo and Pamban the prevailing winds are from S.W. to West, fresh, weather fine but hazy.

October has more unsettled weather, but the sea is smooth; in the first part of this month between Galle and Colombo the weather is fine and the winds from S.W. to N.W., in the latter part, at times, there are heavy squalls with rain. Between Colombo and Pamban the winds are variable, with cloudy, unsettled weather, attended at times with heavy squalls and rain. At Pamban south and south-west winds prevail and occasionally blow strong; towards the end of the month variable winds are experienced.

In **November**, on the south and west coasts of Ceylon, the winds are light and variable between N.E. and W.N.W., with very unsettled weather and frequent heavy squalls and rain; about the middle of the month the north-east monsoon is ushered in by lightning, thunder, and heavy rain. At Pamban the wind, with few exceptions, blows strong and steady from northward and eastward during November.

In **December**, between Galle and Colombo, land and sea breezes prevail, also light variable winds and calms with showers at times, the weather generally being fine and clear. Between Colombo and Pamban

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fresh N.E. and E.N.E. winds prevail; the weather in the first part of the month is generally cloudy and hazy with a few squalls and rain. In the latter part the winds are moderate and the weather much finer.

CYCLONES.*—The Arabian sea and the west coast of India are occasionally, but not frequently, visited by violent storms.

The following table shows the number of storms recorded in the different months to the year 1881 :—

January	4	May	13	September	3
February	3	June	20	October	4
March	2	July	2	November	10
April	9	August	2	December	2

Of the above, twelve were originally formed in the bay of Bengal, and travelled westward across the Indian peninsula. The distribution of these storms according to season is as follows:—

January	1	October	1
April	1	November	4
May	4	December	1

These twelve storms crossed the southern part of the peninsula on a west-by-north, or west-north-west course, and most of them have been traced for a considerable distance across the Arabian sea. The west-north-west track appears to be the most usual across the Arabian sea, but a very important variation of the latter part of this track was presented by the November cyclone of 1886; midway in the steam track between Aden and Bombay, the P. and O. steamer *Peshawar* became involved in this hurricane while endeavouring to escape from it by steaming to the north-west. Having reached the latitude of Bombay and the meridian of 64° E. the storm changed its course rapidly from west-north-west through north-west, and north to north-north-east, and travelling faster than the steamer, overtook it, the centre passing within a distance of 20 miles.

The cyclonic storms generated in the northern part of the bay of Bengal during the summer monsoon, as a general rule break up and disappear after a more or less protracted course over the land; but exceptional instances occur in which they traverse the whole width of Central India on a nearly due west course to Kathiawar and Kutch, and then pass out to the extreme north of the Arabian sea. Such storms are rare. One only occurred during the ten years, 1877–1886, viz., that of the 25th June to the 4th July 1883. Like all storms that cross India, its intensity was greatly reduced while traversing the land, but its strength increased as it neared the western sea, and a British India steamer that

* Climates and weather of India, by H. F. Blandford, F.R.S., F.R.M.S., 1889. The exact number of years embraced by the take of cyclonic storms is unknown.

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became involved in it, in lat. 22° N. and long. 63½° E., experienced winds of hurricane strength.

In 1886 a storm, originating over the middle of the bay of Bengal at the end of September, crossed the peninsula in lat. 17° N. on a due west track, passing out to the Arabian sea about Ratnagiri on the morning of the 3rd October.

Another direction, sometimes taken by cyclones in the eastern part of the Arabian sea, is north-by-west, parallel with the Indian coast. In April 1847 a storm, apparently formed west of cape Comorin, was distinctly traced, first to the north-west, and then north-by-west as far as the latitude of Goa; on the following day the weather moderated and cleared up, but its influence was felt as far north as the gulf of Kutch. On April 21st, 1892, isabnormals indicated the existence of a large depression in the southern part of the bay of Bengal, which was west of Colombo on the 24th, and was far westward of Ratnagiri by the 29th. On May 1st it approached the coast of Kathiawar between Karachi and Verával, its centre passing over Bhuj, where the barometer fell from 29·38 at 8 a.m. to 28·42 at 1.38 p.m.; the wind velocity between 10 a.m. and 1.30 p.m. being more than 100 miles an hour.

In the beginning of June 1885 a cyclone traversed the whole length of the gulf of Aden on an almost due west course. This storm appears to have originated somewhere east of Sokotra on the last days of May. It was fully formed before the 31st, on the early morning of which day the *Mergui* was involved in it in lat. 13° N., long. 59° E. Thence it travelled due west, passing a little north of Sokotra, and on the 2nd and 3rd of June centrally up the gulf of Aden to Obok, and over the African mainland. Its rate of progress averaged between 9 and 10 miles an hour throughout till it neared the land, when its rate of progression seems to have increased. It was small, but very severe and destructive, four steamers, including a German corvette and a French dispatch boat, having foundered in it, with a total loss of 426 souls.

The *Inchulva*, passing the islands of the Red sea on the 1st June, when the storm had not yet reached cape Guardafui, experienced light variable airs with hot sultry weather and a smooth sea. At sunrise of the 2nd June, the day preceding that on which she became involved in the cyclone, the sky was partially overcast "with a very fiery appearance," and at sunset it is described as "looking very bad, green, red, and yellow, all mixed up together, and the atmosphere most oppressive." At night the lightning was incessant, the sky having a red glare all over, and light hot airs from all points of the compass, with showers of rain occasionally, followed by a swell from the eastward, gradually getting heavier.

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The barometer of the *Inchulva* began to fall slightly on the forenoon of the day preceding that on which she encountered the cyclone, and when the centre was yet 450 miles distant, but no rapid fall set in until 8.30 a.m. on the 3rd, only three hours before the centre passed close to the ship, and when it could scarcely have been more than 30 miles distant.

Practical Rules for Seamen in Tropical Cyclones.

When in the region, and in the season of revolving storms, be on the watch for the premonitory signs. *Constantly and carefully observe and record the barometer.*

When there are indications of a cyclone being near, heave-to on the starboard tack, and carefully observe and record the changes of the barometer and wind, so as to find the bearing of the centre, and ascertain by the shift of wind in which semicircle the vessel is situated. Much will often depend upon heaving-to in time.

To find the bearing of the centre.—Face the wind, then the centre of the storm will be from 12 to 8 points to the right; when the storm is distant it will be from 10 to 12 points; and when the barometer has fallen five or six tenths it will be about 8 points.

To find on which semicircle the vessel is situated.—If the wind shifts to the right, the vessel will be in the right-hand or dangerous semicircle with regard to the direction in which the storm is travelling, in which case the vessel should be kept on the starboard tack and increase her distance from the centre. If the wind shifts to the left, the vessel will be on the left or safe semicircle; the helm should be put up and the vessel run with the wind on the starboard quarter until the barometer rises, when the vessel may be hove-to on the port tack; or if the centre of the storm is distant, and running will take a vessel much away from her port of destination, the vessel can be put on the port tack at once. Should the wind remain steady and the barometer continue to fall, the vessel is in the path of the storm, and should run with the wind on the starboard quarter into the safe semicircle.

In all cases act so as to increase as soon as possible the distance from the centre; bearing in mind that the whole storm-field is advancing.

In receding from the centre of a typhoon, the barometer will rise and the wind and sea subside.—*See* the Barometer Annual for full details.

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STORM SIGNALS.—The under-mentioned system of storm signals is established at all the ports of British India, with the exception of those in the river Hugli:—

DAY SIGNALS.—1. Cautionary.—Bay of Bengal.—The square flag W of the International Code, hoisted at the storm signal staff, indicates the existence of disturbed squally weather in the bay of Bengal, which may be the first stage in the formation of a cyclonic storm, and which, if it develops, is likely to affect that part of the coast on which the port, where the signal is shown, is situated.

Arabian Sea.—The square flag *W* of the International Code, hoisted at the storm signal staff, indicates the existence of disturbed weather off the west coast of India near the port or ports where the signal is shown; or the advance of a cyclonic storm across Hindustan from the Bay of Bengal, which may shortly give squally or stormy weather in the Arabian Sea.

In either of the above cases if the disturbed conditions pass away without producing stormy weather, the cautionary signal is hauled down; but if the disturbed weather will probably develop into a cyclone, signals indicating the probable position, character, and track of the approaching storm, are shown as follows:

2. Warning Signal.—A *ball* indicates that a cyclonic storm has formed, which will probably reach the port where the signal is shown, but is still at a considerable distance from it.

The same signal will also be shown at more important ports on the west coast of India to indicate that a storm has formed in the Arabian Sea at some distance from the coast and will shortly cross one or other of the tracks of vessels leaving those ports, but will not reach such ports. The port officer will receive details to communicate to vessels leaving the port.

3. Danger Signals.—(*a.*) A *cone*, apex downwards, indicates that a cyclonic storm, probably slight to moderate, is affecting the port, and that its centre will probably cross the coast considerably to the southward.

(*b.*) A *cone*, apex upwards, indicates that the centre of such a storm, as above (3 *a*), will probably cross the coast considerably to the northward.

(*c.*) A *drum* indicates that the centre of such a storm, as above (3 *a*), will probably cross the coast over or near the port.

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4. Great Danger Signals.—(*a.*) A *cone*, apex downwards, over a *ball*, indicates that a cyclonic storm of great intensity is affecting the port, and that its centre will probably cross the coast considerably to the southward.

(*b.*) A *cone*, apex upwards, over a *ball*, indicates that the centre of such a storm as above (4*a*) will probably cross the coast considerably to the northward.

(*c.*) A *drum*, over a *ball*, indicates that the centre of such a storm as above (4 *a*) will probably cross the coast over or near the port.

NIGHT SIGNALS.—1. No cautionary signals are shown at night.

2. A *red* light indicates similarly to warning signal (2) above.

3. (*a.*) A *red* light placed vertically over a *white* light, indicates similarly to danger signal 3 *a*, above

(*b.*) A *white* light placed vertically over a *red* light, indicates similarly to danger signal 3 *b*, above.

(*c.*) *Two red* lights, placed vertically, indicate similarly to danger signal 3 *c*, above.

4. (*a.*) *Two red* lights placed vertically over a *white* light, indicate similarly to great danger signal 4 *a*, above.

(*b.*) A *white* light over *two red* lights, placed vertically, indicates similarly to great danger signal 4 *b*, above.

(*c.*) *Three red* lights, placed vertically, indicate similarly to great danger signal 4 *c*, above.

At small ports frequented only by country vessels or small coasting steamers, the day and night signals, Nos. 2, 3*c*, and 4*c*, will be the only storm signals shown.

CURRENTS.*—The Trade Drift of the South Indian ocean advances westward from near Australia, and meeting with resistance from the island of Madagascar, begins to split near the islands of Mauritius and Réunion; one portion of the main drift passes northward of Madagascar and strikes the African coast near and northward of cape Delgado, between latitude 11° and 10° S., depending on the monsoon, being at its northern limit during the north-east monsoon period. Here it again splits, one portion flowing southward through the Mozambique channel along the coast, past cape Corrientes and on to Natal; and the other branch northward past Zanzibar, and thence to Ras Asir during the south-west monsoon. During

* *See* Monthly Current charts of the Indian ocean.

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the north-east monsoon it is deflected from the land to the eastward before reaching the equator.

The southern portion of the main drift passes southward of Mauritius, thence southward of Madagascar and direct for Natal, uniting with the stream from the Mozambique, the two together forming the great Agulhas current.

The current setting westward, north of Madagascar, averages 2 miles an hour, not unfrequently 3 miles, but this strength does not extend more than 50 miles northward of cape Amber.

Near the north-west coast of Madagascar there is generally a north-easterly counter-set of about one mile an hour, but more in the offing the current is not to be depended on, especially during the northerly monsoon period. Off Cape St. Andrew the current often sets strongly to the westward.

In the vicinity of the Comoro islands the current generally runs to the westward, but a little to the southward of the islands there is frequently a counter current setting to the eastward. Northward of the Comoro islands a north-westerly current of one or 1½ miles an hour is generally found.*

When the sun is at its greatest north declination and the south-east trade blows nearly to the equator (which period is also that of the easterly monsoon among the islands between Borneo and Australia), the trade drift is augmented by the current from Torres strait, and flows westward past Chagos and Seychelles group till within 200 or 300 miles of the African coast, along which it is forced northward by the southerly breezes of Mozambique channel.

Chagos and Seychelles currents run generally with the wind; for four months, June, July, August, and September, to the west, varying occasionally a little to north or south of that direction; in October, November, and part of December they are very variable; from the middle of December to middle of April they run to the eastward propelled by the north-west monsoon; in the latter part of April and all May they are again variable.

Equatorial channel currents are very strong; for nearly half the year they set westward, and for the other part eastward, according to the monsoon, but are subject to checks from variable winds. In May they commence to set eastward and last till the end of December, but in July and August, when the south-east trade blows nearly to the equator, a westerly set may be expected. In January the current begins to set

* For a full description of the currents through Mozambique Channel and around Madagascar, *see* Islands in the Southern Indian Ocean west of 80° E.; *see also* Monthly Current charts of the Indian ocean.

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westward, receiving its impulse from the north-east monsoon of the bay of Bengal.

Maldive currents.—No general description can be given for the currents in the many channels that exist amongst the Maldive islands; there are but few recorded observations, and these for only a small portion of the year. Regular tides also occur throughout the group, and a tide stream may be mistaken for a current. As a general rule, however, the currents set eastward from June to September, then southerly along the west side of the islands till December, in the end of which month they commence setting westward, and run in that direction till April. In May they are variable and uncertain till the south-west monsoon is established.

Currents about Minikoi. — The north-east monsoon blows strong through the gulf of Manar and over the low northern half of Ceylon in January and February, and the westerly current runs strongly along the south end of that island, and seems to continue its westerly direction till it meets with an obstruction in the long Maldive chain, turning northward close along the northernmost atolls towards Minikoi island, thence north-easterly and curving down again to south-east, thus forming a whirl (in the direction of the hands of a watch) eastward of Minikoi.* This may explain what Horsburgh mentions, that the current sometimes in the north-east monsoon sets to the north-west and northward. In April and May it is variable, but generally southerly with the northerly winds that prevail until the south-west monsoon brings its easterly current of cool water, which the south-east trade has brought with it up to the equator, and which had commenced its north-east set up the African coast early in April. Near Minikoi the current sets in August E.S.E. and in September south-east; for the remainder of the year between south-east and south.†

Laccadive currents are very weak, and run with the wind during the north-east monsoon, only tending generally to make the ebb stream run strong and longer, whilst that of the flood tide is reduced to one or two hours only (*see* tides, page 349); there is sometimes a set to northward when the winds are light and variable, especially after the brisk northerly winds that prevail for two or three days at a time during the

* Captain Selby, E.I.C., surveying brig *Palinurus*, 1853, states, on native information, that the current in January and February always sets past Minikoi to the northward.

† H.M. ship *Undaunted*, which passed through Eight-degrees channel on the 29th August 1875, found, on making the north island of Ihavandiffulu atoll, that she had during the preceding twenty-four hours been set 23 miles S. 5° E., *i.e.*, nearly at right angles to her course, though on the previous day the current had set S.E. by E. (*Navigating-Lieutenant T. Roberson.*)

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north-east monsoon, or rather during the *north-wester* season of the Malabar coast (*see* page 36), when there is almost always a southerly drain along the shore of Hindustan.* From June to September the current sets easterly, and with considerable strength at times, gradually turning more southerly in July, till in October it is south-east, and for the rest of the year very feeble and variable according to the wind.

An excellent proof of the strength of the Laccadive and Malabar current in the south-west monsoon has been given by the washing-up of a seaman's chest near Amblangoddi, about 45 miles southward of Colombo on July 24th, 1865; it came from the ship *General Simpson*, from Bombay bound to Liverpool, wrecked on Chetlat island on June 19th. There seems a little uncertainty about the day when the chest started on its voyage, but the vessel was left by the master with her cargo entire on July 10th, and assuming that as the date, the current must have set at the rate of 36 miles a day in a south-east direction.

The outer or main currents around the south and west coasts of Ceylon, and along the west coast of Hindustan, set generally in the direction of the prevailing monsoon, the velocity depending greatly on the force of the wind; the inshore currents are influenced more or less by local circumstances, and at times set in an opposite direction to those in the offing. During the **north-east monsoon** the main current off the south end of Ceylon runs in a westerly direction through the Maldive islands at the rate of 18 to 30, and occasionally to 40 or 50 miles a day; about midway between Ceylon and these islands part of the main current branches off in a north-westerly direction towards Minikoi, when it again turns to the westward. In the eastern part of the Arabian sea during the north-east monsoon the main current sets in a south-westerly direction 12 to 18 miles a day, increasing to 30 and 40 miles in the middle, but when the wind is light there is little or no current.

During the **south-west monsoon** the main current in the northern part of the Indian ocean runs in an easterly direction through the Maldive islands, and along the south coast of Ceylon, at the rate of 18 to 60 miles a day. The currents in the Arabian sea at this season are regular in direction, but their velocity depends much on the force of the wind and local circumstances. The general direction in the middle of the sea is about East averaging 12 to 30 miles a day, inclining to the south-east and increasing in strength as it approaches the west coast of Hindustan, where it runs occasionally 30 to 40 miles a day.

* The German gunboat *Wolf* on her passage from Aden to Colombo in January 1879, with the wind from N.N.E., found the current in Nine-degrees channel setting N. 58° W. at the rate of 0·9 mile an hour.—*Annalen der Hydrographie, Berlin*, 1879.

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Inshore currents.—During the **north-east monsoon** a strong current sets in a southerly direction along the east coast of Ceylon, especially in the months of November and December, rounding the south coast in a westerly direction as far as Point de Galle; thence to the north-west parallel with the coast, at times as far north as lat. 8° 10′ N., when it again turns to the westward. Its velocity averages 30 to 60 miles a day, and on the south-east side of the island a set of 108 miles has been recorded in 24 hours. During this monsoon a current runs through Adams bridge from the bay of Bengal, and down the gulf of Manar in a south-westerly direction, then close round cape Comorin and along the west coast of Hindustan in a north-westerly direction averaging 12 to 30 miles a day; outside this current from abreast cape Comorin to Ceylon there is a south-easterly set. Close inshore along the Malabar coast there is scarcely any current until after February, when it runs weakly in a southerly direction, increasing in March and April.

On the Kathiawar coast, during the months of November and December, the current generally sets to the north-west 10 to 30 miles a day, but at times there is a slight current in the opposite direction, particularly at night.

During the **south-west monsoon** the current runs in a south-easterly direction at the rate of 10 to 42 miles a day along the west coast of Hindustan, dividing off cape Comorin; one part sets in a north-easterly direction 12 to 30 miles a day through the gulf of Manar, the other in a south-easterly direction 18 to 24 miles a day, towards the south end of Ceylon, thence along the coast at the rate of 24 to 48 and at times 78 miles a day.

The current off Colombo is subject to considerable variation, particularly about the changes of the monsoon, when it is strongest; generally speaking it sets with the monsoon parallel to the coast, and is never so strong as to cause inconvenience in making Colombo.

Through the Pamban pass the current frequently attains a velocity of 5 to 6 knots an hour.

TIDAL STREAMS.—The tidal wave strikes the coast of Hindustan from the westward at right angles to the mean direction of the shore line, thus causing very little difference in the times of high water along the whole length of coast, except where there are indentations, such as the gulfs of Cambay and Kutch.

From about Jaigarh, that is, 100 miles south of Bombay, to Mangalore, and mount Dilli, high water occurs at about the same hour, 10 h. 45 m., and no tidal stream is observed along the coast, except just off the mouths of rivers where the ebb seems to run out to sea, and the flood sets on to the embouchures.

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Along the coast of North Konkan the flood stream sets northward; strong off Bankot, and its strength increases with the latitude, till, at the river of Cambay, it finishes with the well-known "Bore" of Mahi and Sabarmati rivers.

Southward of mount Dilli the flood stream is just appreciable as coming from the north-west, and off Cochin it is plainly so. Between Cochin and the west coast of Ceylon the irregularities of the tides and the diminished rise and fall seem to indicate some unusual cause.

At Colombo four floods and four ebbs have been observed in the course of 25 hours, and the difference between high and low water only 6 inches. This may be attributed to the bifurcation of the ocean tidal wave at the Maldive group, which has the same effect as a continent interposing. Northward from these islands two waves advance; the one inclining eastward, toward the gulf of Manar, causes high water at Colombo and cape Comorin about the same time.

Karachi and Porbandar receive the tidal wave earlier than any other ports of India, and hence we see the flood tide setting eastward along the coasts of Sind and Kutch, northward along the Okhamandal coast, and south-east along the Kathiawar coast to Diu head, where it has been found to run one to 1½ miles an hour to the eastward. Off Diu head there are frequently eddies, doubtless caused by the ebb stream of the gulf of Cambay running westward while the flood stream from Porbandar is running eastward.

Where evaporation is so great, as it is in the Indian seas, there are doubtless some local movements of the ocean water dependent upon that cause; where the rise of tide is great, as in the gulf of Kutch, this cause may be little appreciated; but at Cochin, the ingoing stream has been known to be constant for 20 hours, although the regular, but inconsiderable, rise and fall of little more than one foot has been marked on the tide gauge.

SOUNDINGS.—The 100-fathoms contour-line of soundings along the western shores of Ceylon and Hindustan is now well delineated on the charts, but the nature of the bottom varies so much that but little general description can be given. In the gulf of Manar it is principally sand and coral rock, and the same off cape Comorin. Along the Malabar coast, southward of Quilon, the bottom is principally sand and shell with little or no mud; between Quilon and mount Dilli, the mud extends out to depths of 20 and 30 fathoms; and between mount Dilli and the entrance to the gulf of Cambay the bottom is composed of mud, sand, shells, and coral as far as the 100-fathoms limit.

Off the south-west coast of Ceylon, the bank of soundings extends nowhere so much as 15 miles; northward of Colombo, to only about

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10 miles; and to less than half that distance off Kalpentin and Karativo. From the latter place the edge of the bank trends north-west towards Pamban, and at 15 miles south of that town there is no bottom at 100 fathoms. The continuation of the bank, off the Tinnevelli coast to Comorin, has not been thoroughly examined; and its outer edge cannot be correctly defined, but south of Comorin it stretches 45 miles, and to the south-west 55 miles off shore.

At from 3 to 8 miles southward of cape Comorin the bottom is fairly even, with a depth of about 20 fathoms; between the cape and Anjengo the depth of 10 fathoms lie at about one mile from the mainland.

The bank of soundings off Anjengo extends 25 miles from the coast, upon which are depths of 20 fathoms at 3 miles, and 30 fathoms at 10 miles; off Quilon the depths are 10 fathoms close in to the foul ground, 20 fathoms at 5 miles, 30 fathoms at 15 miles, and 100 fathoms at 27 miles.

Off Alleppi and Cochin the depths are respectively: 10 fathoms at 6 and 5 miles, 20 fathoms at 11 and 15 miles, 30 fathoms at 17 and 22 miles, with the edge of the bank of soundings distant 30 and 35 miles.

Upon the coast bank of soundings there are some shoals which serve as direction banks to contiguous harbours; these will be noticed off their respective ports. There are also some outlying banks, between which and the bank of soundings there are depths of 900 to 1,000 fathoms. These outlying banks, which are fully described in their respective chapters, consist of the Elicalpeni, Padua, Sesostris, Cora Divh, and Angria banks. The Elicalpeni only is shallow ($3\frac{3}{4}$ fathoms having been found upon it), and must be avoided as dangerous; the others, being well submerged, may be sounded upon to ascertain the ship's position.

COMMUNICATION.

RAILWAYS. — TELEGRAPH. — There are (1897) about 20,390 miles of railway open for traffic in British India, exclusive of 59 miles of lines in French and Portuguese territory; in addition to which 4,138 miles of line are under construction, or already sanctioned for construction. About three-fourths of the above are State lines, the remainder being guaranteed or assisted companies, and those belonging to native states. From Bombay, the chief terminus in Western India, railways run in every direction, and afford ready access to all the principal lines in Hindustan. Karachi is the most important point of departure for the northern and north-western provinces. Other parts, as Tuticorin, Calicut, Goa, and Kathiawar are also connected with the general railway system of India. Telegraphic connection is being greatly extended

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throughout the country; there are now about 50,000 miles of line in use, all important places being in communication with each other, and with the various submarine systems to all parts of the world.

In Ceylon there are about 300 miles of railway open, running from Colombo inland to Kandi, &c., and southward along the coast beyond Point de Galle to Matura. All important places are joined by telegraph, and are also united to the submarine connection; there were 1,727 miles of line in use in 1896.

Point de Galle.—Steam vessels and electric telegraph to all parts of the world; also by railway to Colombo.

Colombo.—Steam vessel to all the principal ports in Ceylon twice monthly, and frequently between England, India, and Australia. There is railway communication along the coast, through Kaltura to Galle, and with Kandi and Nawadipilaya, also a branch from Kandi to Matillo. Colombo is in communication by electric telegraph with all parts of the world.

Pamban.—By electric telegraph to all parts.

Tuticorin.—By steam vessel to Bombay, Calcutta, and intermediate ports; also by the weekly line of coasting steam vessels to Colombo. By railway to Madras, Madura, and the cotton districts; and also by electric telegraph to all parts.

Quilon.—By continuous water communication formed by backwater and canal with Trivandrum to the south, a distance of 40 miles, and Shoranur (a railway station) to the north, 155 miles. The vessels of the British India Steam Navigation Company call here occasionally during the fine season. There is telegraphic communication with all parts of India.

Cochin.—By steam vessel, weekly, to Bombay, Colombo, Calcutta, and all the important ports on the east coast of India during the fine season. Electric telegraph to all parts. The backwater communication can be carried on with the neighbouring ports and surrounding country throughout the year.

Beipur and Calicut.—To all important parts on the coast during the fine season by steam vessel. By railway to Madras, with branches to Ballari, Bangalore, and Mysore; and by electric telegraph to all parts.

Goa.—By the British India Steam Navigation Company's vessels weekly during the north-east monsoon; there is also communication with Bombay and the intermediate ports every other day by small passenger steam vessels, which run from October to the middle of May. From Murmagao by railway with British districts of the south Mahratta country, and by electric telegraph with all parts of India. Good roads lead from Panjim to all important towns in Goa, and there is also communication

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by steam ferry with the principal villages on the Mandavi and Zuari rivers.

Janjira.—There is communication with Bombay daily during the fair weather season (October to May) by small steamers, carrying the mails, which visit Alibagh, Rewadanda, and Janjira, thence down the coast to Goa, calling at the several ports on the way.

Bombay.—By steam vessels to all the principal ports in India, and by several lines of steam vessels to Europe. Bombay is connected by railway with the Central Provinces, also with Baroda, Poona, and Madras. There is telegraphic communication with all parts of the world.

Mahuwa.—The nearest railway and telegraph stations to Mahuwa are at Bhaunagar, distant by road 60 miles, with which place there is a daily post service. Coasting passenger steam vessels call in at Kadpur bay occasionally during the N.E. monsoon on their way from Jáfarábád to Bhaunagar.

Salbet.—The nearest railway and telegraph station to Salbet is 60 miles distant, and the nearest post office (Bherai) 5 miles distant.

Beit.—Communication is maintained by small native vessels with Mandvi, and a post runner conveys the mails daily between Aramra and Dwarka. From Aramra to Beit the post boat crosses daily at high water.

Karachi.—There is direct communication with Europe by eight regular lines of steam vessels, with at least one vessel of each line, leaving once a month. A weekly steam vessel runs to the Persian gulf and Basra. Coasting steam vessels communicate with Bombay and the Kutch and Kathiawar ports. There is communication also by railway with the Indian system, and by electric telegraph with all parts of the world.

COAL can be obtained at Point de Galle, Colombo, Bombay, and Karachi; and when able to be spared at Tuticorin and Murmagao. Coal may also be had at the Seychelles islands, and at Mauritius.

PASSAGES.

FULL-POWERED STEAM VESSELS.*—By these vessels passages are always made as direct as circumstances will permit.

Aden to Bombay.—Direct. Distance, 1,650 miles.

Aden to Ceylon.—Direct. Distance to Colombo, 2,100 miles; to Point de Galle, 2,130. From April to October vessels should pass north of Sokotra to avoid the heavy cross seas to the southward of it during the S.W. monsoon.

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* *See* Admiralty chart of the World, No. 1,077, showing the tracks followed by full-powered steam vessels, and "Ocean Passages, 1896."

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Aden to Karachi, Maskat, and Persian Gulf.—Direct. Distances:—To Karachi, 1,450 miles; to Maskat, 1,200; and to Basra, 1,970. Coal can be obtained at Maskat.

Bombay to Aden.—Direct, except in June, July, and August, when the S.W. monsoon is unusually heavy, when vessels keep on the parallel of Bombay until about 100 miles from the Arabian coast, and thence along that coast, passing about 20 or 30 miles outside the headlands. The distance by the northern route is 1,680 miles.

The sea and wind are at their height between the meridians of 66° and 60° E.; farther west both wind and sea begin to abate.

Another route, in June, July, and August, for vessels that cannot take the above is to pass westward of the Laccadive islands, under fore-and-aft sails, and when in about 9° N., where the wind becomes lighter and the water smoother, to make westing, so as to reach the meridian of 61° E., in about latitude 7° N. Thence a vessel should edge off to the north-west for Ras Asir, taking care not to go to the northward of 10° N. until in 53° E., so as to avoid the heavy cross sea caused by the whirling current southward of Sokotra. The distance by this route is about 2,200 miles.

Bombay to Cape of Good Hope. — Direct for the Mozambique channel, thence down the African coast in the strength of the Mozambique and Agulhas currents until abreast of Mossel bay, and thence direct round cape Agulhas. During the height of the S.W. monsoon (June, July, and August) a vessel should steer to cross 5° N. in about 65° E., thus avoiding the strongest part of the monsoon, and from thence pass westward of the Seychelles group (if not calling there for coal), and then down the Mozambique, as before.

Another direct route is by passing to eastward of the Seychelles group and Madagascar, thence making the African coast about 120 miles southward of Natal.

A longer route is by passing eastward of Saya de Malha, and westward of Cargados Carajos to Mauritius; thence south of Madagascar to the African coast, as before. Distances:—Bombay to Mauritius, 2,540 miles; Mauritius to Cape of Good Hope, 2,270 miles.

Bombay to Ceylon, Karachi, and Persian Gulf.—Direct. Distances:—To Colombo, 900 miles; to Karachi, 500; to Basra, 1,620.

Bombay to Zanzibar.—From May to September, during the S.W. monsoon, a vessel should steer to cross 5° N. in about 65° E., and then go direct for Zanzibar. Distance, 2,700 miles.

See chart, No. 1,077.

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During the remainder of the year the route is direct. Distance, 2,530 miles.

Cape of Good Hope to Bombay.—The route is direct along shore as far as Algoa bay, thus avoiding the strength of the Agulhas current, and being sometimes assisted by a counter current extending from one to six miles off-shore, but guard against a probable indraught, especially during and after gales, and avoid all salient points.

After passing Algoa bay a vessel should edge off to about 90 miles from the shore, where the current is weaker, and thence steer direct for and through the middle of the Mozambique channel, and afterwards direct for Bombay, passing west of Mayotta island and the Cosmoledo group. Distance, 4,582 miles.

If calling at Seychelles for coal, after passing Juan de Nova island, a vessel should steer as direct as possible for the Seychelles, and from thence direct to Bombay.

(If passing eastward of Europa island, in the Mozambique channel, the distances would be about 40 miles greater in each case, but the currents more favourable.)

Another route is to round the south end of Madagascar (giving it a berth of not less than 100 miles to avoid the strength of the westerly current), and thence pass westward of Réunion, Mauritius, and Saya de Malha bank, direct to Bombay, calling at Mauritius or the Seychelles for coal, if necessary.

Steamships can only rely on a full supply of coal, in the South Indian Ocean, at Mauritius and Seychelles.

Cape of Good Hope to Ceylon.—There are two routes. One through the Mozambique channel, calling at Seychelles for coal if necessary, and thence through the One-and-a-half-degree channel. Distance to Colombo, 4,510 miles.

The other passing about 200 miles southward of Madagascar, calling at Mauritius for coal, if required, and thence proceeding direct, passing either eastward or westward of the Chagos archipelago.

In the first route, at all seasons of the year, there will be less heavy seas and adverse winds to encounter, and, in consequence, less wear and tear of the vessel. The distance is about 130 miles greater.

Ceylon to Aden.—Direct, passing north of Sokotra from May to October.

Ceylon to Seychelles and Zanzibar.—April to October.—Through the One-and-a-half-degree channel, and thence direct.

See chart, No. 1,077.

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November to March.—Through the Eight-degree channel, and thence direct.

Karachi and Persian Gulf, to Aden and Bombay.—Direct.

Zanzibar to Bombay.—April to October.—Keep along the coast in the strength of the current until in about 1° N., and then steer direct.

November to March.—Direct.

SAILING AND AUXILIARY STEAM VESSELS.*—General Remarks.—Vessels with sail and auxiliary steam power may be considered as taking nearly the route of vessels under sail only, unless especially mentioned. Such vessels, and also steam vessels of but moderate power and little sail assistance, would at times take the full-powered steam route, and must under all circumstances be greatly guided by their coal endurance and steaming capacity.

The routes to be selected depend upon the season of the year, and will be described in detail.

ADEN TO BOMBAY.—April to September.—Direct. Vessels should keep in the centre, or rather towards the Arabian shore of the gulf of Aden, to avoid the westerly current on the African coast. During the strength of the S.W. monsoon, in June, July, and August, when the weather is thick and heavy, and observations very uncertain, vessels should steer direct for Kundari island, and should watch the soundings carefully.

October to March.—Vessels should work, or steam, along the coast of Arabia, taking advantage of every shift of wind. Should the current be strong in-shore, it is better to stand out 60 or 80 miles from the land; if the wind be light, advantage should be taken of the tides and land winds in-shore, anchoring when requisite. When off the Khorya Morya islands, stretch over for Bombay, and as easting is made, the wind will draw to north or even westward of north. This is a very tedious passage for sailing vessels, and is seldom attempted by them.

ADEN TO CEYLON.—April to October.—Pass north of Sokotra, and thence through the Eight-degree or Nine-degree channel.

October to March.—Sailing Route.—Work along the Arabian coast as far as Ras Fartak, or just beyond it, before standing across the Arabian sea for the Eight-degree or Nine-degree channel.

Auxiliary Steam Route.—Steam along the coast of Arabia to beyond Ras Fartak, thence under sail across the Arabian sea, passing on either side of Minikoi island.

* *See* Admiralty chart of the World, showing tracks followed by vessels with sail and auxiliary steam power, No. 1,078, and "Ocean Passages, 1896."

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ADEN TO KARACHI, MASKAT, AND PERSIAN GULF.—May to September.—Along the Arabian coast, but not too close to the shore as the weather is hazy, and when past the Khorya Morya islands the wind sometimes falls light. For Karachi steer direct as soon as possible, making Manora light.

For Maskat, after rounding Ras al Hadd, work, or steam, along the coast.

For the Persian Gulf, after rounding Ras al Hadd, stand over to the northern shore of the gulf of Omán, under steam or sail, and keep along that shore.

In the gulf of Omán, after rounding Ras al Hadd, the S.W. monsoon is lost, and light winds and calms are experienced.

October to March.—Either work, or steam, along the Arabian coast. When up to Ras al Hadd stand across to Karachi; or to the northern shore of the gulf of Omán if bound to the Persian gulf.

This is a very tedious passage and is seldom attempted by a sailing vessel.

BOMBAY TO ADEN.—May to September.—Sailing route.—It is usual after the setting in of the S.W. monsoon for sailing vessels to make what is called the southern passage, or to run down south of the equator into the S.E. trade to make their westing. After gaining an offing into 15 or 20 fathoms water (or even to 40 fathoms in the first part of the S.W. monsoon as the wind then hangs much to the southward) a vessel may steer down the coast, keeping in soundings of from 40 to 50 fathoms; this is advisable to keep clear of the Laccadives in the thick, overcast, rainy weather that may be expected, when observations may not be obtainable for days together. After passing these islands make as little easting as possible. The wind will be from S.W. to W.S.W. with hard westerly squalls; a S.S.E. current of 20 to 30 miles a day will be experienced.

Cross the equator, and when fairly in the S.E. trade run to the westward, passing south of the Chagos archipelago, and north-east of the Seychelles group, and recross the equator in 53° or 54° E. Run through the S.W. monsoon, and make the African coast between Ras Hafûn and Ras Asir,* due consideration being given to the strong north-easterly current which will be experienced on nearing the land. Pass close round Ras Asir, and keep along the African coast up to Burnt island, and then stand across the gulf of Aden.

* A full description of the land about Ras Hafún, and Ras Asir, as also of the soundings off that coast, will be found in Gulf of Aden Pilot.
See chart, No. 1,078.

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Auxiliary steam routes.—Similar to the sailing route, but using steam between the S.W. monsoon and the S.E. trade, and also along the north coast of Africa from Ras Asir to Burnt island.

An alternative route is to pass east of the Laccadive islands, through the Nine-degree channel and down to the parallel of about 4° N. Thence on about that parallel to about 60° E., and thence to the north-westward for Ras Hafún and Ras Asir.

Caution.—As many large and valuable vessels have been wrecked on the coast to the southward of Ras Asir (Cape Guardafui), the utmost caution is necessary when rounding this headland from the southward or south-eastward, during the S.W. monsoon, when the weather is stormy, accompanied by a heavy sea and strong current, and the land is generally obscured by a thick haze.

During daytime a gradual change will probably be seen in the colour of the water from blue to dark green; and the water becomes smoother, and the swell alters its direction to the eastward of south, when the meridian of Ras Hafún is passed.

To ensure safety, however, when the land cannot be clearly seen and recognized, especially at night, the *lead, and the lead alone, can be relied on.*

October to April.—Sail and auxiliary steam route.—Direct, but towards the end of the N.E. monsoon (after mid-March) vessels should pass southward of Sokotra, as light south-westerly and westerly breezes may then be expected near this island; and late in April vessels should pass *well* (about 50 miles) to the southward of Sokotra.

The same route applies to vessels from other ports on the western coast of India, vessels from Cochin passing through the Nine-degree channel, and those from Mangalore or Kannanur passing north of the Laccadives.

BOMBAY TO CAPE OF GOOD HOPE.—Sailing routes.—February to October.—Stand down the coast of India and across the equator into the S.E. trade (*see* Bombay to Aden, page 69) and thence steer to pass southward of Mauritius and about 100 miles southward of Madagascar, and make the African coast about 200 miles south of Natal. From thence keep in the strength of the Agulhas current to abreast Mossel bay, and thence direct round cape Agulhas.

November to January.—Direct to and westward of the Comoro islands, thence along the African coast in the strength of the Mozambique and Agulhas currents.

In rounding the Cape with westerly winds, keep on the Agulhas bank, not more than 40 or 50 miles from the shore, where the sea will be smoother.

See chart, No. 1,078.

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Auxiliary steam routes.—March to October.—As in the sailing route from February to October, but using steam through the variables between the S.W. monsoon and the S.E. trade.

November to February.—As in the sailing route through the Mozambique channel, using steam through the southerly winds at the southern end of the Mozambique.

BOMBAY TO KARACHI.—N.E. monsoon.—Sailing route.—In September and October, also in March and April, when north-westerly winds are general, work direct for Diu head, and thence along the coast. In November, December, January, and February work along the coast with the land and sea breezes, sighting St. John high land before crossing to Diu head, as the wind hangs much to North and N.N.E. across the gulf of Cambay. Watch, and remember the set of the tides.

November is a calm month along the south coast of Kathiawar, and it is frequently necessary to anchor on the flood to avoid being swept into the gulf of Cambay.

From November to January north-easters blow fresh outside the gulf of Kutch, when vessels working into it should anchor during the ebb off Dwarka or Kutchgurh, and start with the flood across the mouth of the gulf to make the Kutch coast, where the water is smoother, and a vessel can work to the eastward.

Auxiliary steam route.—Direct, taking advantage of the land and sea breezes when possible.

Sail and auxiliary steam route.—S.W. monsoon.—In May and early in June, on leaving Bombay, make westing so as to be able to weather Diu head, by 100 miles if bound into the gulf of Kutch, or by 200 miles if for Karachi. During June, July, and August vessels for Karachi should be careful not to make the coasts of Sind and Kutch previous to sighting Manora lighthouse, as there is a south-easterly set, and the wind is liable to lull occasionally inshore, leaving the vessel with a heavy swell and lee current.

In the first part of the S.W. monsoon the flood tide setting into the gulf of Kutch is greatly accelerated.

BOMBAY TO THE PERSIAN GULF.—N.E. monsoon.—Sail and auxiliary steam routes.—In September and October, and also in March and April, when light north-westerly winds are general, vessels should go as direct as possible, keeping towards the northern shore of the gulf of Omán, and not making the Arabian coast unless calling at Mascat.

See chart, No. 1,078.

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From November to February, inclusive, the passage is facilitated by the N.E. monsoon, and a vessel should stand to the north-westward, passing not far from the Kathiawar coast until in latitude 23° or 23½° N., and thence stand to the westward. The N.E. wind may be carried to Maskat or Ras al Kuh, but more probably will be lost in longitude 62° or 63° E., when north-westerly winds will be met. Vessels should keep along the northern shore of the gulf of Omán, and if bound to Maskat should not close the Arabian shore until Maskat bears to the southward of south-west.

S.W. monsoon.—Sailing route.—In May, or early in June, westing should be made on leaving, so as to be able to stand for the gulf of Omán with the first of the S.W. monsoon. In June, July, and the first part of August vessels should take the southern passage (*see* page 69), and after making sufficient westing, recross the equator in about 56° to 57° E., and run through the S.W. monsoon for Ras al Hadd. Thence towards Persian gulf.

Auxiliary steam route.—As in the sailing route, using steam from the S.W. monsoon into the S.E. trade, and also after passing Ras al Hadd. Or, from inside the Laccadive islands, steam through the Nine-degree channel and to the westward between about 7° and 9° N. until in about 65° E. Thence direct for Ras al Hadd.

CAPE OF GOOD HOPE TO BOMBAY.—Sailing routes.—April to October.—There are four: the Mozambique channel route, the east of Madagascar route, the Boscawen passage, and the Middle passage.

1. The Mozambique Channel, or Inner route, is the most direct for vessels bound to any part of India during the S.W. monsoon, but it must not be taken unless there is certainty of reaching India before the close of the monsoon.

On leaving the Cape, if a south-easterly wind prevail, a vessel should stand to the southward, and run down the easting, in lat. 39° to 40° S., to about 30° E. long.; if a westerly wind prevail, the vessel should run along the coast, guarding against any indraught, and not go to the northward of about 35° S. until in 37° E., when a course may be shaped for the Mozambique channel, passing eastward of Europa island and on either side of Juan de Nova. From thence a vessel should pass through the Comoro islands, cross the equator in 53° or 54° E., and steer direct for Bombay.

The winds in the Mozambique channel do not blow with the same regularity that is found further north, and are generally stronger in the middle of the channel. The northerly monsoon commences between

See chart, No. 1,078.

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mid-September and mid-October, and the change is usually accompanied by squally weather.

In the height of the S.W. monsoon, June, July, and August, when the weather is thick and heavy, and observations very uncertain, vessels should make Bombay on the parallel of Kundari island, and should use the lead freely.

2. The passage east of Madagascar is often preferred to the Mozambique channel, as it is less dangerous and the winds are more steady, particularly in August and September, when light variable winds are found in the Mozambique. This passage also must only be used when there is a certainty of reaching port before the monsoon is over.

A vessel on leaving the Cape should make easting in 39° to 40° S. until in about 45° E., and thence stand to the north-eastward, crossing 30° S. in about 53° E. From thence the vessel should run through the trade, passing westward of Réunion, the Farquhar, and Amirante islands; then cross the equator in 53° or 54° E., and steer direct for Bombay.

3. The Boscawen passage is to be preferred to the foregoing when there is any uncertainty of reaching port before the commencement of the N.E. monsoon.

On leaving the Cape stand to the southward, and when in 39° to 40° S. make easting to about longitude 50° E. From thence stand to the north-eastward, and cross 30° S. in about 59° E., and then run to the northward through the trade, passing between Mauritius and Réunion, and to the westward of the Saya de Malha bank. Cross the equator in about 62° E. and steer direct for Bombay.

4. Middle passage.—Towards the end of the south-west monsoon vessels have used what is called the Middle passage, but it is not recommended, as more calms would probably be met with. By this route cross 30° S. in about 67° E., run northward through the trade on the meridian of 66° E., and endeavour not to cross the equator to the eastward of 68° E.

In case the N.E. monsoon has commenced vessels should get in with the coast of Hindustan after passing the Maldive islands.

November to March.—Stand to the southward on leaving the Cape, and make easting in 39° to 40° S., or even to the southward of the parallel of 40° S. in January, until in long. 65° E., when stand to the north-eastward and enter the trade (26° to 28° S.) in 80° to 83° E. Run through the trade and N.W. monsoon, cross the equator in about 85° E. (some authorities say 80° E., but it is more prudent to be farther eastward), and make

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See chart, No. 1,078.

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northing into the N.E. monsoon, when stand for cape Comorin and work up the Malabar coast with the land and sea breezes.

Auxiliary steam routes.—April to October.—Follow the sailing route through the Mozambique channel or that east of Madagascar if certain of carrying the S.W. monsoon to Bombay, otherwise follow the Boscawen passage. Steam will probably only be necessary when using the Mozambique channel after July, or the Boscawen route so late that the S.W. monsoon is over before Bombay is reached.

The distances would be:—By the Mozambique route, 4,930 miles (or if obliged to make easting in 39° S., 5,370 miles); by the east of Madagascar route, 5,740 miles; and by the Boscawen route, 5,760 miles.

November to March.—As in the sailing route, but crossing the equator in 80° to 81° E., and steaming into the N.E. monsoon, and also along the Malabar coast.

CAPE OF GOOD HOPE TO CEYLON. — Sailing routes.—April to October. — The outer passage lies eastward of Chagos archipelago, and is taken by vessels if they expect to cross the equator from April to October with a certainty of gaining their port before the south-west monsoon is over. From the Cape stand to the southward and thence make easting to 58° E. From thence stand to the north-eastward and enter the trade (between 26° to 28° S.) in about 77° E. Run to the northward through the S.E. trade into the S.W. monsoon, and thence proceed direct.

If leaving the Cape with a westerly wind, the most direct route (about 530 miles shorter than the above) is through the Mozambique channel, as described in the passage to Bombay (*see* page 72), and after crossing the equator, making direct for the Eight-degree channel, and thence to Ceylon.

Should the Boscawen passage be used, after passing between Saya de Malha bank and the Seychelles, steer to cross the equator in 62° E., and thence through Eight-degree channel.

If the Middle passage be adopted in March, April, September, or October, a vessel, after reaching the equator, may run to the eastward, keeping nearly on or a little south of it, and pass through One-and-a-half degree channel or southward of the Maldive islands.

November to March.—As for Bombay (*see* page 73), but cross the equator in not less than 85° E.

Auxiliary steam routes.—April to October.—As in the sailing routes. If taking the Outer, Boscawen, or Middle passages, steam

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See chart, No. 1,078.

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will be required through the variables between the S.E. trade and S.W. monsoon. If taking the Mozambique channel route, steam may be required in the Mozambique channel.

November to March.—As in the sailing route, using steam between the S.E. trade and N.W. monsoon, and also from the N.W. monsoon into the N.E. monsoon.

CEYLON TO ADEN, SEYCHELLES, AND ZANZIBAR.—Sailing routes.—April to September.—Stand at once across the equator into the S.E. trade, thence run westward, passing southward of the Chagos group, and north-eastward of the Seychelles; recross the equator in about 53° or 54° E. and shape course to make the African coast at Ras Hafún.

Vessels for Zanzibar pass southward of the Seychelles islands.

Auxiliary steam routes.—As in the sailing route, but using steam from the S.W. monsoon into the S.E. trade, and again from Ras Asir along the north coast of Africa. If the S.E. trade is found near the equator, as it may be in June and July, the necessary westing may be made in 4° to 5° S., instead of to the southward of the Chagos group.

During May a vessel of fairly good power may with advantage steam direct through the One-and-a-half degree channel.

Sail and auxiliary steam route.—October to March.—Through the Nine-degree channel, and then direct for either of the above places. After mid-March vessels should pass south of Sokotra as light south-westerly and westerly breezes may then be expected near this island.

KARACHI TO BOMBAY.—Sail and auxiliary steam route.—Direct, but in June, July, and August vessels should at first get an offing into 15 or 20 fathoms before standing to the southward, and Bombay should be made on the parallel of Kundari island, and the soundings be carefully attended to. There is considerable indraught into the gulf of Kutch from March to September.

ZANZIBAR TO BOMBAY.—Sailing routes.—April to October.—Keep along the coast in the strength of the current till in about 1° N., and then steer direct.

November to March.—Work to the eastward into the N.W. monsoon, then run to the eastward on about the parallel of 5° S. until in 82° or 84° E., when stand to the northward across the equator into the N.E. monsoon and make the south end of Ceylon, and then cape Comorin; hence work up the Malabar coast with the land and sea breezes.

See chart, No. 1,078.

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In March it would perhaps be better to go direct when the N.W. monsoon is met with, as north-westerly winds are prevalent in the Arabian sea at the end of the N.E. monsoon.

Auxiliary steam routes.—April to October.—As in sailing route.

November to March.—Steam into the N.W. monsoon. Then run to the eastward on about the parallel of 5° S. until in 70° E.; from thence north-eastward across the equator in 80° to 81° E., and steam up the Malabar coast.

In March proceed direct when the N.W. monsoon is met with. Coal can be obtained at Seychelles.

WEST COAST OF HINDUSTAN.—Full-powered steam routes.—Direct both ways.

Sailing routes.—Bound to the northward.—June to August.—No vessels attempt to work up the coast after May until September, at which time but few of the ports are visited.

September and October.—The passage northwards in these months is very tedious; on the southern part of the coast a strong current sets constantly to the southward, and the wind is north-west and variable, with frequent light airs; vessels often anchor to avoid being drifted back. The weather is threatening at times, with heavy showers.

Vessels by any of the southern passages bound up the coast, that cannot cross the equator eastward of longitude 60° or 62° E. by the beginning of October, should, if the wind permit, pass through Nine-degree channel, and steer northward of East, until obtaining soundings in 40 or 50 fathoms; then keep to the northward and work up near the shore with the land and sea breezes. The land winds commence about the beginning of October, below Calicut, but do not extend far off shore until November.

December, January, and February.—The regular land and sea breezes render navigation northward easy near the coast, where the sea is remarkably smooth, and the sea breeze strongest.

March and April.—The land breezes will generally fail in strength and duration northward of mount Dilli; vessels should, therefore, particularly in April, be well out in 35 or 40 fathoms, about noon, that they may be able to make a long stretch to the N.N.E. or N.E. with the north-west winds. If near the shore early in the evening, and the wind be at north-west, make short tacks, until the breeze veers to

See charts, Nos. 1,077 and 1,078.

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northward, which may be expected early in the night; then stretch off N.W. or W.N.W. to be ready for the sea breeze of the following day.

When a strong north-wester sets in, it is liable to continue for two or three days, or longer, rendering it impracticable to gain any ground when working near the coast. At such times vessels should keep about 60 miles or more from the land, where the winds are generally moderate and the sea smooth.

May.—Late in April, or during May, vessels should keep a good offing towards the Laccadives, and when to the northward of those islands should keep a greater offing still, in case of a gale coming on.

A vessel on the southern part of the coast below mount Dilli meeting with north-west winds in this month should stretch off to westward of the islands, passing between Suheli and Minikoi, or between any of the Laccadive islands, to benefit by the approaching westerly winds.

Bound to the southward there is no difficulty except at the commencement of the S.W. monsoon, when the wind hangs to the south-westward; vessels should then get a good offing into 40 or 50 fathoms off Bombay, and keep on the edge of the bank in those depths (*see* page 69). On proceeding southward the wind will generally become more favourable, veering to west and W.N.W.

Between Cochin and Cape Comorin southerly currents and W.N.W. winds prevail from mid-July to mid-October.

Auxiliary steam routes.—Direct, if bound either way, but giving the coast a good berth during the height of the S.W. monsoon.

Caution.—During the south-west monsoon (from about the middle of May to the middle of September), the ports on the Malabar coast are virtually closed, and many of the buoys temporarily withdrawn.

UNIFORM SYSTEM OF BUOYAGE.

The following is the Uniform System of Buoyage adopted for Indian waters:—

1. The Mariner, when approaching the coast, must determine his position on the chart, and must note the direction of the main stream of flood tide.

2. The term Starboard Hand shall denote that side which would be on the right hand of the Mariner, either going with the main stream of flood, or entering a harbour, river, or estuary from seaward; the term Port Hand shall denote the left hand of the Mariner under the same circumstances.

See chart, No. 1,078.

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3. Buoys showing the painted top of a cone above water shall be called *Conical*, and shall always be Starboard Hand buoys, as above defined.

4. Buoys showing a flat top above water shall be called *Can*, and shall always be Port Hand buoys, as above defined.

5. Buoys showing a domed top above water shall be called *Spherical*, and shall mark the ends of Middle Grounds.

6. Buoys having a tall central structure on a broad base shall be called *Pillar* buoys, and, like other special buoys, such as *Bell* buoys, *Gas* buoys, *Automatic Sounding* buoys, &c., &c., shall be placed to mark special positions, either on the coast or in the approaches to harbours, &c.

7. Buoys showing only a mast above water shall be called *Spar* buoys.

8. Starboard Hand buoys shall always be painted a single red colour.

9. Port Hand buoys shall be painted of another characteristic colour, either black or parti-colour.

10. Spherical buoys at the ends of Middle Grounds shall always be distinguished by horizontal stripes of white colour.

11. Surmounting topmarks, such as staff and cone, &c., shall always be painted of one dark colour.

12. Staff and Cone shall only be used on Starboard Hand buoys; Staff and Cylinder on Port Hand; Globes at the outer ends of Middle Grounds; and Half Globes, round part uppermost, at the inner ends.

13. Buoys on the same side of a channel, estuary, or tideway may be distinguished from each other by names or consecutive numbers or letters, commencing from seaward, and when necessary by a staff, surmounted by the appropriate topmark.

14. *Fairway* buoys shall always be painted in horizontal stripes of white colour, and shall be surmounted by a staff only.

15. Buoys intended for mooring, &c., may be of shape or colour according to the discretion of the Authority within whose jurisdiction they are laid, but for marking Submarine Telegraph Cables the colour shall be green, with the word *Telegraph* painted thereon in white letters.

Buoying and marking of Wrecks:—

16. Wreck buoys in the open sea, or in the approaches to a harbour or estuary, shall be coloured green, with the word *Wreck* painted in white letters on them.

17. When possible, the buoy shall be laid near to the side of the wreck next to mid-channel.

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18. When a wreck-marking vessel is used, it shall, if possible, have its top-sides coloured green, with the work *Wreck* in white letters thereon, and shall exhibit:—

By day:—Three balls on a yard 20 feet above the sea, two placed vertically at one end, and one at the other, the single ball being on the side nearest to the wreck.

By night:—Three *fixed white* lights, similarly arranged, but not the ordinary riding light.

19. In narrow waters, or in rivers, harbours, &c., under the jurisdiction of Local Authorities, the same rules may be adopted, or, at discretion, varied as follows:—

When a wreck-marking vessel is used, she shall carry a yard on a mast, with two balls by day, placed horizontally, not less than six nor more than 12 feet apart, and *two* lights by night, similarly placed.

When a barge or boat only is used, a flag or ball may be shown in the daytime.

The position in which the marking vessel is placed, with reference to the wreck, shall be at the discretion of the Local Authority having jurisdiction.

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CHAPTER II.

GULF OF MANAR.—POINT DE GALLE TO CAPE COMORIN.
(Between long. 80° 15′ E. and 77° 30′ E.)

VARIATION 0° 30′ E. in 1900.

The Gulf of Manar is formed by Ceylon on the east; Rameswaram and Manar islands, and Adam's Bridge, on the north; and by the coasts of Madura and Tinnevelli on the west. Its extreme breadth from Point de Galle to cape Comorin is 200 miles.

SOUTH-WEST COAST OF CEYLON.

GENERAL REMARKS.—Aspect.—The Haycock, a conical mountain, 2,160 feet high, situated N. by E. $\frac{3}{8}$ E., 19½ miles from Point de Galle lighthouse, is conspicuous from the offing. Adam's peak, 7,353 feet high, may also be seen in clear weather.

The land westward of Point de Galle is generally low, with cocoa-nut trees near the sea; to the eastward it is formed of several ridges of hills of various heights.

Soundings.—The bank of soundings extends about 12 miles south-westward of Point de Galle, and sailing vessels may anchor on it in less than 40 fathoms, with a stream or kedge, should the wind fail and the current be unfavourable. Gallehogalle bank, bearing S.W. by W., 3 miles from Point de Galle, has depths of 16 to 22 fathoms on it.

Caution.—Sailing vessels approaching Point de Galle harbour should be careful to keep a weatherly position to enable them to sail in, and it should be borne in mind that the current sets along the line of coast with great velocity—to the east during the south-west monsoon, and to the west during the north-east monsoon. Vessels during the south-west monsoon, by getting to leeward of the port, have taken weeks to regain their position, and in some instances have been compelled to bear up for Trincomali or to recross the equator.

See charts, Nos. 828 and 813.

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UNAWATTI POINT, the south-east headland of Point de Galle harbour, is steep, rocky, covered with trees, and conspicuous to a vessel approaching from the eastward. The white tower on Watering point, the north-west extreme of this headland, is conspicuous with the afternoon sun on it; but Edward's pillar, painted *white*, and 264 feet above the sea, standing nearly a mile northward of Unawatti point is not so easily recognised. When Unawatti point bears north-west, distant 10 to 12 miles, it may be known by a clump of trees on the seaward slope of the hill; and, if the weather be clear, the flagstaff and lighthouse at Point de Galle will be seen about one-quarter of a point open to the westward of it.

Bellows rock, about $1\frac{1}{3}$ cables in extent, lies with its south-western edge S. by E. $\frac{3}{4}$ E. about 6 cables from Unawatti point. The sea always breaks on this rock; very heavily in bad weather. There are several rocks between it and Unawatti point. The signal staff on Neptune battery open westward of Point de Galle lighthouse, bearing N.W., leads one cable outside Bellows rock.

Ereminia Galle point, situated about $1\frac{1}{4}$ miles E. by S. $\frac{3}{4}$ S. from Unawatti point, is a bluff projection covered with cocoa-nut trees to the water's edge, and is the most salient point eastward of Bellows rock.

POINT DE GALLE HARBOUR is formed between Point de Galle and the sloping land eastward, on the summit of which, 264 feet high, stands Edward's pillar, about 50 feet in height; thence the land trends to the south-east, terminating in Unawatti point. Watering point, upon which stands a white tower, is a rocky bluff a little more than a mile E. by S. $\frac{1}{2}$ S. from Point de Galle, and forms the eastern limit of the harbour. The actual entrance is narrowed, and the anchorage within much confined, by numerous dangerous rocks. At the head of the harbour is a low sandy beach bordered with cocoa-nut trees. Near the centre are two rocky promontories known as Gibbet island and Glosenburg.

The land in the vicinity of Point de Galle is comparatively low and ill-defined, but the position of the harbour may be readily known by the lighthouse, which stands at the west point, and Edward's pillar to the eastward. On the west point the fort and town are built, the sea front being rendered inaccessible by a line of coral reefs, on which the sea breaks heavily. Off the lighthouse point several rocky islets extend a quarter of a mile southward; these are all above water. Outside these islets submerged rocky shoals extend to S.S.E. for 7 cables from the lighthouse point, which are dangerous to sailing vessels in consequence of the strong

See plan of approaches to Point de Galle harbour, No. 819.

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currents which run past them; these currents set in an easterly or westerly direction according to the monsoon. The anchorage frequented by shipping is in 6 to 4 fathoms sandy bottom, on the west side of the harbour, abreast the fort.

Point de Galle harbour, though confined, is considered a safe place at all seasons of the year, but with strong south-west winds a ground-swell tumbles in; it is frequented as a port of call for orders.

Coal.—About 20,000 tons of coal are kept in stock. It is shipped in bags from lighters.

Repairs.—Small repairs can be executed to hull and machinery.

Supplies can be obtained. Water may be procured at a small bay within Watering point, or native boats can be hired to bring it alongside.

Hospital.—Seamen are admitted to the Civil Hospital, which is commodious and built on a healthy site. There are no special quarantine regulations at Galle.

Shipping.—In the year 1896 the port was entered by 164 vessels of 281,232 aggregate tons. The importance of the place has considerably declined in consequence of the development of Colombo.

Communication.—Steam.—Telegraph.—The steam vessels of the British India Company afford fortnightly communication with all parts of the world *viâ* Colombo; and with the coast ports of India also every fortnight. Galle is connected by telegraph with Colombo, Trincomali and other ports in Ceylon, and with all parts of the world by the system of India. There is railway communication with Colombo *viâ* Alutgama and Kalutara.

Population.—The population (1891) of Galle within the municipality is 33,590.

Life-boat.—A life-boat is stationed at Point de Galle.

Draught of vessels.—Point de Galle harbour is available to vessels of 24 feet draught. The deepest draught vessel that has visited the port was one drawing 24½ feet.

LIGHT.—A *group flashing white* light is exhibited at an elevation of 100 feet above the sea, from an iron tower 80 feet high, and painted white, on the south bastion of the fort on Point de Galle; the light shows *two flashes* every *half minute*, thus:—*Flash two seconds, eclipse three seconds, flash two seconds, eclipse twenty-three seconds.* It is visible in clear weather from a distance of 15 miles.

Position.—Lat. 6° 1½′ N., long. 80° 12½′ E.

See plan of Point de Galle harbour, No. 820.

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Signal Station is on Neptune battery, about a quarter of a mile north-westward of Point de Galle lighthouse.

Pilots.—Merchant vessels should not proceed northward of Outer Kadda rock without a pilot, and will usually be met by the pilot canoe outside these rocks. Bad weather may, however, prevent the boats from leaving the harbour, in which case the directions (*see* page 87) should be closely followed.

Commanders of steam-vessels should keep a position clear of the Outer Kadda buoy until the pilot shows his flag (white, red and white horizontal,) when it is safe to steer for the pilot's canoe. If under sail the canoe is distinguishable by the letter P on it, with the Pilot flag shown above; should the buoy be out of position, the usual signals from the flagstaff will be made.

OFF-LYING DANGERS.—Kadda rocks consists of three disconnected patches, the whole 2 cables in extent, N. by E. and S. by W., with only 12 feet on the shoalest part. There is deep water between the rocks. During the south-west monsoon these rocks are marked by heavy breakers; but in the north-east monsoon there is seldom a break.

Outer Kadda, the southernmost, on which the least depth is 13 feet, lies S. by E. $\frac{3}{4}$ E., about two-thirds of a mile from Point de Galle lighthouse, with the white mark on the east side of Point de Galle harbour almost shut in with Watering point.

Buoy.—Kadda rocks bell-buoy, red, is moored in 12 fathoms, $2\frac{3}{10}$ cables S. $\frac{1}{2}$ E. from Outer Kadda rock, with Point de Galle lighthouse bearing N. 17° W., distant 9 cables, and the tower on Watering point N. 58° E. If the buoy is not in position, keep Ereminia point *well* open to the southward of Unawatti point, E. by S.

Middle Kadda, with 12 feet on it, lies about midway between the Outer and Inner Kadda rocks.

Inner Kadda has 15 feet on its shoalest part, from which the Pilot's tree is in line with the left extreme of Flat rock N. $\frac{3}{4}$ W., and the Signal flag-staff is in line with the north end of Pigeon island N.W by N.

Alut ground, with 7 fathoms on it and 11 fathoms close around, lies S.E. by E. $\frac{1}{4}$ E. half a mile from the Outer Kadda with Edwards pillar bearing N.E. by E. $\frac{1}{4}$ E. and Point de Galle lighthouse N.W. $\frac{3}{4}$ N.

Para rock, with five fathoms on it, lies $2\frac{1}{2}$ cables E. by N. from the Outer Kadda; from the centre of Para rock, Point de Galle lighthouse and east end of Elephant rock are in line; and the white mark is shut in with Watering point.

See plan of Point de Galle harbour, No. 820.

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Inner Para rock, with a depth of 4½ fathoms on it, lies three-quarters of a cable N.E. by N. from Para rock, with the white mark in line with the northern lower edge of Watering point bearing E. by N. ⅞ N., and the flag-staff on Neptune bastion just touching southern side of the lighthouse N.W.

DANGERS WESTWARD OF POINT DE GALLE HARBOUR.—Gindura rock.—This rock, called Medda by the natives, lies W. by N. ¼ N. nearly 4¼ miles from Point de Galle lighthouse. From its shoalest part of only 6 feet water (which is very dangerous, as the sea does not always break over it), Haycock mountain appears a little to the left of the small white-topped Gull rock one mile north-west of Gindura town N.N.E. ½ E.; there are depths of 4 and 5 fathoms around Gindura rock at about two-thirds of a cable from it, and 15 fathoms at two cables outside the rock. A small coral patch, of 3 fathoms, lies 6 cables N.E. by E. ½ E. from it. The channel within Gindura rock should be avoided.

To pass outside Gindura rock, vessels approaching Galle from the north-westward should keep Akorali point well open westward of Waal islet N.N.W. ¼ W., until Edward's pillar is open southward of Point de Galle lighthouse E. ¾ S.

Buoy.—An iron nun buoy, painted red, and surmounted by a flag, is moored in 11 fathoms, about 2 cables southward of Gindura rock.

Whale rock, under water, bears W. ⅜ N. 2½ miles from Point de Galle lighthouse, and is 1½ miles from the nearest shore; it always breaks, but in fine weather only once in about four or five minutes, so that a good look-out is necessary. There is no safe channel inside of it, the bottom being rocky, and the soundings irregular. A shoal lies about midway between Whale rock and the shore, with 3¾ fathoms on it, and there are many shoal spots within half a mile of the coast. There are 7 fathoms close outside Whale rock, and 20 fathoms at less than half a mile off.

Buoy.—A conical red buoy is moored about 3 cables S.S.W. from Whale rock.

Caution.—Too much reliance must not be placed on the buoys marking the outer dangers near Point de Galle, as they are liable to break adrift.

Little Whale rock (Grampus) is a small rock above water, lying about half-way between Whale rock and Point de Galle lighthouse. There are many rocks inside of it with from 3 to 6 feet water on them. Kadra-wella, a small bank with a depth of 8 fathoms, lies about 3 cables south-east of the Little Whale.

See plan of approaches to Point de Galle harbour, No. 819.

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DANGERS EAST SIDE OF ENTRANCE.—Several groups of rocks lie between Watering point and the fairway channel leading to the anchorage, the outermost extend nearly in a straight line in the direction of Point de Galle.

Imburinha rock, with 4 fathoms water, is the south part of a rocky ridge of 5 fathoms, one cable in length north and south, and bearing W. by N. ¾ N. 2½ cables from Watering point.

Deumba Dava rock, on which the sea breaks during the south-west monsoon, has 12 feet on it, and lies about midway between Imburinha and Mata Mada.

Buoy.—A black and white vertically striped buoy is moored a short distance south-west of Deumba Dava rock.

Kabira rocks, two in number, half a cable apart, in a north and south direction, lie about 2 cables north-east from Deumba Dava, the northern has 18 feet and the southern 21 feet water over it.

Ketti rock, on which the least water is 15 feet, lies 1½ cables to the northward of Kabira rocks, with the belfry seen just open of Schwarte fort, and the Pilot's tree (on Mudlia hill 157 feet high) open its own breadth west of Alexander's house.

Bokolosava rock, with a depth of 3½ fathoms over it, lies about 3 cables N.N.E. from Watering point.

Mata Mada rocks form the eastern boundary of the fairway into the harbour. These rocks on which the sea breaks consist of two distinct patches about half a cable apart.

Buoy.—A red buoy is moored in 6 fathoms, a short distance westward of the inner and shoalest patch of 6 feet.

Wara rocks, on which the sea breaks, have only 3 feet on their shoalest part, and lie rather more than one cable north-east from Mata Mada.

Avaria rock, with 4½ fathoms on it (reported dredged to 5 fathoms), lies directly in the channel to the anchorage, midway between Kapera and Wara rocks, with the lighthouse seen open of Utrecht bastion, and the right extreme of Schwarte fort N. 58° W. distant 4 cables.

Kata rocks consist of a long ledge, extending in a south direction from near the west end of Gibbet island, towards Wara rocks. There are several detached patches on the ledge, with 6 to 18 feet on them, and deep water around.

See plan of Point de Galle harbour, No. 820.

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Buoy.—A red buoy is moored in $5\frac{1}{4}$ fathoms westward of the 6-feet patch.

INNER DANGERS.—Tanna rock, with 4 fathoms on it, lies nearly 2 cables westward of Gibbet island.

Gull rock a small round rock, about 5 feet in diameter, standing 3 feet above the sea level, lies 2 cables north-east from the landing-place. There is a large iron ring on its summit, to which native vessels secure their stern hawsers.

Kasambera rock is a small patch with 15 feet on it that lies N.E. by E. $1\frac{1}{4}$ cables from Gull rock.

Aan rock is a similar patch of 15 feet lying 2 cables off the coaling pier, and N.N.W. $\frac{1}{4}$ W. from the west point of Gibbet island.

DANGERS WEST SIDE OF ENTRANCE.—Mimattia rock, on which the sea breaks in bad weather during the south-west monsoon, is half a cable in extent, with 17 feet on it. This rock lies nearly in mid-channel between the Inner Kadda and the islets off the lighthouse.

Polkatti rock, on which the sea breaks, has only 3 feet on it, and lies one cable S.E. by E. from Flat rock.

Buoy.—A black buoy is moored in $6\frac{3}{4}$ fathoms, about 30 yards E.S.E. from Polkatti rock.

Bellikatua rock has 15 feet on it, and forms, with the inner Mata Mada patch (distant $1\frac{1}{4}$ cables in an E. by N. direction), the narrowest part of the entrance to the inner portion of the harbour. The sea breaks on this rock in bad weather during the south-west monsoon.

Buoy.—A small black conical buoy is moored near the east edge of Bellikatua rock.

Kapera rock, situated about 2 cables northward of Bellikatua, has been levelled to a uniform depth of 30 feet at low water.

Buoy.—The black buoy, moored eastward of Kapera rock, is retained in its former position, for anchorage purposes.

Vellikoko reef consists of two rocky patches, with 3 to 9 feet water, the shoalest part being towards the northern end.

Buoy.—A black buoy is moored in four fathoms to the eastward of Vellikoko reef.

Outer Anchorage.—In clear weather the Haycock, in line with Point de Galle lighthouse N. by E. $\frac{3}{8}$ E., will lead to the outer roadstead.

See plan of Point de Galle harbour, No. 820.

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During the north-east monsoon the best anchorage off Point de Galle is in about 16 fathoms, with the Pilot tree and lighthouse in line, and Unawatti rock on with Ereminia Galle. The Pilot tree (not easily distinguished) is situated on Mudlia hill, which is 157 feet high, and nearly a mile northward of the lighthouse. During the south-west monsoon, vessels should not anchor in the road, but if compelled to do so, the best temporary anchorage will be in the same depth of water with the lighthouse bearing N.E. distant about 1½ miles.

Tides.—It is high water, full and change, in Point de Galle harbour at 2 h. 3 m.; springs rise about 2 feet. The tidal streams are very weak, and have little influence upon the current, which runs strongly, as stated on page 80.

DIRECTIONS.—Vessels should not approach the coast north-westward of Point de Galle, as it has never been properly surveyed, and rocks may exist that are not marked on the charts. No vessel, unless well acquainted with the locality, or compelled to seek refuge, should attempt to enter Point de Galle harbour without a pilot (*see* page 83). During the north-east monsoon (from December to March inclusive), the harbour is at all times accessible to sailing vessels, and anchorage can be easily reached; for a sea-breeze varying from south-south-east to west generally prevails during some part of each day. Early in the morning the wind is generally off the land from northward, and enables sailing vessels to leave the harbour. During the south-west monsoon (from April to November inclusive), though the wind frequently veers round even to northward of west, there is generally a heavy swell setting directly into the mouth of the harbour from the south-west; this sometimes occasions difficulty in bringing a vessel up in an anchorage so confined as to compel vessels to be moored by means of stern hawsers, which, if required, are supplied by the local authorities.

Approaching the harbour from westward.—By bringing Point de Galle lighthouse to bear E. by N., a vessel will pass clear to the southward of Gindura, the Whale, and Little Whale rocks. The rocky islets off the lighthouse may be approached in safety so long as the church in the fort,* or the Pilot's tree, is seen westward of the lighthouse; here, southward of the Outer Kadda rocks, the pilot's boat will generally be found.

Vessels requiring a pilot should heave-to with the lighthouse bearing from N.E. to N.N.E., distant about one mile.

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* The church in the fort is not so conspicuous as was formerly the case owing to the erection of new buildings, it may, however, be identified as being close to the westward of a tower.

See plan of approaches to Point de Galle harbour, No. 819.

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West Entrance.—In the south-west monsoon the passage north-west of Kadda rocks is only used in case of urgent necessity. To pass north-westward of Kadda rocks bring Edwards pillar in line with the white tower on Watering point N. 87° E.; this will lead between Mimattia rock and Inner Kadda rock. Proceed with this mark on until the west end of the church in the fort comes in line with Elephant rock, or the Roman Catholic Chapel (north-north-west of the town), is in line with the lighthouse; then steer about N.E. by E. ½ E., or for Gravet point (the termination of the high land in the north-east corner of the harbour), until the flag-staff on Neptune bastion is in line with lighthouse. Thence alter course to N. by E. ¼ E. for the police station at the head of the bay, proceeding in mid-channel between the black buoy of Polkatti and the red buoy of Mata Mada. These buoys with the others within, black on the port, and red on the starboard hand, entering from seaward, will then be the guides. When the lighthouse is shut in with Utrecht bastion, anchor in about 5½ fathoms, one cable north-eastward of Kapera buoy. Vessels usually have to moor head and stern in this small harbour.

East Entrance.—To pass southward of Kadda rocks, keep Pilot tree westward of the lighthouse, until you bring Ereminia Galla *well* open of Unawatti point; then steer E. by S. towards Unawatti until Pilot tree is open eastward of all the fortifications. Then haul up to north-east for about 2 cables, and when Pilot tree comes on with Polkatti (the outer black) buoy, steer for it (about N. by W.) until the flag-staff and the lighthouse are in line; thence proceed, as above directed, between the Polkatti and Mata Mada buoys.

THE WEST COAST OF CEYLON is low near the sea, and much planted with cocoa-nut and other trees. Inland the mountains attain a great elevation; Adam's peak, the highest land visible from off the west coast, rises to a height of 7,353 feet, and is 35 miles from the sea; it is veiled in haze during the south-west monsoon, though an excellent landmark for two-thirds of the year. The culminating peak of Ceylon is Pedrotalagala, about 20 miles north-eastward of Adam's peak, and nearly 900 feet higher. South-westward of Adam's peak there is much elevated country.

Soundings.*—Off the south-west coast of Ceylon, the bank of soundings extends less than 15 miles; northward of Colombo, to only

* In 1874 a bank, several miles in length with 12 to 16 fathoms over it, was reported by the French transport *Arreyon* about 13 miles westward of Point de Galle; and, in 1879, the French corvette *Victorieuse* found 9¼ and 12 fathoms near the position indicated.

See plan of Point de Galle harbour, No. 820.

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about 10 miles; and to not more than half that distance off Kalpentin and Kara Tivo. From the latter place the edge of the bank trends north-west towards Pamban, and at 15 miles south of that town there is no bottom at 100 fathoms.

Between Galle and Colombo the soundings at the edge of the bank are mostly less than 30 fathoms, deepening occasionally somewhat inshore. Vessels in this locality, and uncertain of their position, should not approach the land at night after soundings have been once obtained.

Between Galle and Colombo vessels should keep upwards of 5 miles off shore during daylight, some of the outer dangers on this coast lying 3 miles from the land.

Gindura river is nearly midway between Point de Galle and Dodandowi point; to the north-west of the river entrance the coast is low and sandy; to the south-east it is rugged and rocky. From Point de Galle to Waal point the land near the coast has a level appearance, and is covered with cocoa-nut trees.

Godda bank, on which the depth is 4 fathoms, rock, lies S.W. ½ W. about 1¾ miles from Dodandowi point. Senegammi point, just open westward of Waal islet, leads inside Godda bank.

DODANDOWI, a village with a custom-house on a small river, is 7 miles north-westward of Point de Galle lighthouse; the river entrance is north of the village, and has two rocky islets off it, at less than one cable from the sandy shore; the northern islet, called Medda, affords some shelter from southerly winds to the landing-place at the river's mouth. Manda, the southern islet, is on the shore reef, and one cable from Medda.

Dangers:—Dodandowi rocks, always breaking, lie a quarter of a mile W. by N. from Manda; Orava rock, with 6 feet water on it, is situated one cable N.N.W. ¼ W. from Dodandowi rocks; vessels should pass westward of both these dangers, and of Hikodi rock, when entering or leaving Dodandowi anchorage.

Hikodi rock, the outermost danger in Dodandowi bay, lies nearly 1¼ miles W. by N. ½ N. from Medda islet; it is small, has 6 feet water over it, and deep water all round. Half a mile inshore of it lies Un reef, with many rocks between it and the coast. Debaha rock well open westward of Waal islet leads westward of Hikodi rock; and Medda islet bearing East leads southward.

Anchorage.—Dodandowi outer anchorage is in 6 or 7 fathoms, sand, 2 cables north-westward of Medda rock; and with the breakers on

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[1] See chart, No. 813, and plan on it, of Dodandowi bay.

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Dodandowi rocks bearing about S.S.W. Small vessels may anchor farther in, about one cable northward of Medda rock.

Tides.—It is high water, full and change, at Dodandowi bay at 1 h. 50 m.; ordinary springs rise 1½ feet.

Waal point, situated 2⅓ miles north-westward of Dodandowi, is low, and covered with cocoa-nut trees. Off it lies Waal islet, high and rocky, with smaller islets near.

Senegammi point, 2 miles further north-westward, is low and rocky. **Debaha rock,** a few feet high, and divided into two parts, lies half a mile south-west of Senegammi point. The village of Hikadowi is midway between Waal and Senegammi points; a gap in the reef, which here fringes the coast, affords a passage for small boats to the anchorage off the village.

Akorali point, in lat. 6° 11½′ N., long. 80° 3½′ E., and situated 2½ miles N.W. by N. from Senegammi point, is low, sandy, and covered with cocoa-nut trees.

Tung and Vatang rocks lie near the coast off Akorali point, and the ground in that vicinity is generally foul.

Passi rock is small and above water, with a bank, on which the sea breaks heavily, extending from it about 2 cables to the southward; from Passi rock Akorali point bears E. by N. ½ N. 1 1/10 miles. A sunken rock is reported to exist half a mile W.S.W. of Passi rock, and another rock is said to lie 3 or 4 cables northward.

Gindavana islet, about 2½ miles N.N.W. of Akorali point, and a quarter of a mile off shore, is rocky, and of moderate height. Amblangoddi rest-house, a conspicuous building from seaward, stands on the summit of a rocky cliff, half a mile south-eastward of Gindavana; close to the southward of the rest-house is an opening in the rocks forming a cove, with a sandy beach about 100 yards in extent, and anchorage for boats in 2½ fathoms water. A small river has its mouth to the south of Amblangoddi, and off it are several rocks. Off Patiagalle point, which is three-quarters of a mile S.E. by S. from Gindavana islet, is another rock called Radul. White coral is found in quantities on this part of the coast, and shipped to Colombo and Point de Galle, where, when calcined, it forms the only lime used for building purposes.

Wathu bank, having a depth of 3 fathoms, lies nearly a mile westward of the village of Amblam.

Muta Amarata Boka point, at 5 miles N.N.W. from Akorali point, rocky and of moderate height, has close to the north of it the entrance

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See chart, No. 813, and plan on it, of Dodandowi bay.

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of the Balapitti Modere, a small river navigable only by boats. A custom house stands on the north side of the entrance, where the shore is low and sandy.

Myimba rocks, two rocks, elevated a few feet above the water, lie a quarter of a mile westward of Muta Amarata Boka point, and are surrounded by a reef.

Ahungalle point, low and rocky, bearing North 2 miles from Muta Amarata Boka, is the southern extreme of some rocky cliffs half a mile in length, the northern end of which, called Kosgoddi hill, is of considerable height. On the summit of the cliffs near Ahungalle point stands a house, conspicuous from seaward.

Several high rocky islets, and rocks having only 2 to 6 feet water over them, lie from one-quarter to three-quarters of a mile off the coast between Muta Amarata Boka and Ahungalle points. Cabravanna rock, above water, is situated close to Ahungalle point.

Alut rock, with only 8 feet water on it, and deep water around, lies 1¼ miles west from Ahungalle point. From the rock Haycock hill is in line with the house on the summit of the cliff near Ahungalle point. Gindavana islet, well open westward of Myimba rocks, about S.E. ½ S., leads westward of Alut rock.

Napa rock, lying 1¾ miles N.W. of Cabravanna rock, and one mile off shore, has 2 fathoms water on it, and 8 fathoms close outside; it forms the northern extreme of Konda bank, which extends southward to half a mile inshore of Alut rock.

Utari bank, rocky, with 4 fathoms upon it, lies parallel to the shore, with its southern end half a mile seaward of Napa rock, and its northern extreme one mile west from Kerevanni rock.

Unapayagalle point, 4¼ miles N.N.W. from Ahungalle point, is low and rocky, and continues so for one mile in a southerly direction to Nyakandugalle point, but between this last and Kosgoddi hill the shore is sand. Kerevanni rock, small and white-topped, stands a quarter of a mile south-west from Unapayagalle point.

Dodompara rocks, showing above water, are half a mile north west from Unapayagalle point; between these rocks and Udapitta point, at less than half a mile off shore, lie several other rocks with from 3 to 6 feet water on them, and a quarter of a mile north-west from Dodompara rocks there is a patch with a depth of 2 fathoms.

Galboda Dagoba, a hill 145 feet in height, 1½ miles N.N.E. of Unapayagalle point, stands about half a mile from the beach.

See chart, No. 813.

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Udapitta point, 3¼ miles N. by W. ½ W. from Unapayagalle point, is rocky and of moderate height, with Andevan rocks lying half a mile W.N.W. from it. There are several sunken rocks, with 3 to 4 feet water on them, between Andevan rocks and Udapitta point.

Bentotti river entrance lies a short distance northward of Udapitta point; the town of Bentotti is on the south bank, and half a mile from the bar, on which there are only 3 or 4 feet water; but the depth varies according to the season, being greater after heavy rains, when the bar becomes navigable for the native coasting craft. In the river there is a depth of one to 2 fathoms. As the sands on the bar frequently shift, and there is generally a surf, boats should not attempt to cross it without a pilot.

Barberyn island, standing about 2 cables off the mainland, to which it is connected by rocks, is 3 miles north-north-westward of Udapitta point, and may be recognized by its lighthouse. There is anchorage northward of Barberyn island in 6 or 7 fathoms, and small craft may anchor in a small bay farther in, with 2 fathoms, sandy bottom.

LIGHT.—A *flashing white* light, showing a quick flash *every minute*, elevated 150 feet above the sea, and visible 18 miles in clear weather, is exhibited from a circular white lighthouse, 103 feet high, erected on the summit of Barberyn island.

Position.—Latitude 6° 28′ N. and longitude 79° 58′ E.

Mana Golla rock, with a depth of 3½ fathoms, lies with Barberyn island, E.S.E., three-quarters of a mile. Goda Golla rock, with a depth of 5 fathoms on it, and Rama Cate rock, with 4 fathoms, lie between Mana Golla rock and Barberyn island.

Fanny rock, with 3½ fathoms water on it, and 13 fathoms close around, lies with Barberyn lighthouse, bearing E.S.E. 2¾ miles, and Beach hill N.E. by E. About 1¼ miles N.W. by W. from this rock there is a small patch of 7 fathoms.

Nawoellikandi rock is a high rock, situated 2¾ miles northward of Barberyn island, and one mile west of Maguna point. A sunken rock lies half a mile to the southward of Nawoellikandi, and a rocky patch with 3 fathoms, 1¼ miles, N. by W. ½ W. of it.

KALTURA FORT, on the east bank of Kalu Ganga river, and about three-quarters of a mile N. by E. from its entrance, is 7 miles northward of Barberyn lighthouse. The land, on which the fort stands, is slightly elevated; a sandy shore extends from Kaltura to Maguna point,

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See chart, No. 813.

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1½ miles north-eastward of which is Beach hill. Kaltura is a considerable town with 10,864 inhabitants (1891), and is connected with Colombo and Galle by railway.

Two-fathom rock lies one mile off shore, and 1¾ miles S.W. ¾ S. from Kaltura fort; it has a depth of 12 or 13 feet on it, and does not break, except in such bad weather as would forbid a ship communicating with Kaltura.

Uheli reef, formed of coral, about three-quarters of a mile in length, but narrow, has depths of 3½ to 4 fathoms. The least water is at its southern end, from whence Kaltura fort bears E. ½ N., distant 2¼ miles.

DIRECTIONS.—A vessel approaching Kaltura should keep about 5 miles off shore until the Fort bears E.N.E., or is in line with Adam's peak, if it is visible; which bearing or mark leads between Uheli reef and Two-fathom rock. Vessels anchor in 5 to 6 fathoms about one mile from the entrance of the river. Bombuwela hill, 517 feet high, lies 4 miles eastward of Kaltura.

The COAST between Kaltura and Pantura is low and sandy, and abundantly planted with cocoa-nut trees. A canal joins these places and Negombo. Near this part of the coast caution should be used, and the soundings not be shoaled to less than 20 fathoms.

Desaster rock, off a village of that name, lies close to the shore, about 1¼ miles to the north-west of Kaltura fort; there are sunken rocks both to the north and south of it.

Kaluwattegala rock, with a depth of 3½ fathoms, lies about 2½ miles off shore, with Kaltura fort S.E. ¾ E., and Pantura N. by E.

Veyangula rock, with 5½ fathoms on it, lies W.N.W. about 6 cables from Kaluwattegala rock.

Nilkete rock, with a depth of 2 fathoms, is situated about 1½ miles from the nearest shore, and 2 miles S.W. ½ S. of Pantura.

A rock, with 4 fathoms over it, lies half a mile W.N.W. from Nilkete rock. Two small rocks, with depths of 3 fathoms, lie S. by W. about 3 cables from Nilkete rock.

PANTURA.—This large town, 8 miles N.N.W. from Kaltura fort, is at the mouth of a river which flows from Pantura lake. On the south side of the entrance are two rocks above water, with others submerged, between and to the northward of them. **Gonagala** rock, the outer, is nearly a mile W.S.W. from the town, and has a depth of 7 fathoms close outside. The anchorage is westward of these rocks in 10 or 12 fathoms, nearly 2 miles off shore; and in approaching it care must be taken to avoid the

See chart, No. 813.

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Nilkete and other rocks to the southward. A conspicuous high tree stands behind the cocoa-nuts, 2½ miles northward of Pantura, and nearly one mile from the beach. About 2 miles W.N.W. from this tree, and half a mile off shore, is a rocky bank of 3 fathoms, about one mile in length, opposite the village of Digorella.

Mount Lavinia is a rocky headland, nearly 8 miles north-north-west of Pantura, and 6 miles to the southward of Colombo; on it is a conspicuous white building. A narrow rocky bank, 2 miles in length, with one fathom least water, lies about half a mile from, and parallel to, the coast southward of mount Lavinia, abreast which headland the 10-fathoms contour-line is distant less than half a mile.

Southward of Colombo, along the shore, lies the suburb of Kolpetti, with its numerous villas. The open space south of the fort is called the Galle-face.

Approach to Colombo.—Westward of Colombo the bank of soundings extends off about 10 or 12 miles, with depths less than 30 fathoms immediately within its edge. South-westward of the harbour the bank is fairly level, and the depths are over 20 fathoms, until within 5 miles from the shore.

North-west of Colombo, about 2 miles inside the 100-fathoms contour-line, is a coral bank, with 11 or 12 fathoms on it, the depths increasing a few fathoms in places to the eastward of the bank.

The coast about Colombo is low, fringed with cocoa-nut trees, and not visible more than 10 miles from seaward. The lighthouse, which is also the clock tower, All Saints' church spire (the only spire) and the black dome of the Dutch church are the most conspicuous marks.

When making the port from the southward, mount Lavinia white house is a useful object for identifying this part of the coast. In the north-east monsoon, Adam's peak, which has been seen at a distance of 90 miles, may be useful as a mark for approaching Colombo from the westward.

COLOMBO.—LIGHTS.—A *group flashing white* light, showing *three flashes* in quick succession every *thirty seconds*, each flash lasting *two seconds*, separated by an eclipse of *three seconds*, and followed by an eclipse of *eighteen seconds* is exhibited from the clock tower standing in the centre of the fort. The light is dioptric, of the first order, elevated 135 feet above high water, and is visible in clear weather from a distance of 17 miles.

Breakwater lights.—From a lighthouse on the extremity of the South-west breakwater is shown a *fixed red* light, elevated 56 feet above

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See chart, No. 813, and plan on it, of Colombo harbour.

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high water, which should be visible in clear weather from a distance of 12 miles.

From the western end of the staging of the North-east breakwater, now in course of construction, is exhibited a *fixed green* light, which is situated (September 1897) 633 yards S. 82° W. from the western side of Mutwal point. This light is moved outwards as the works progress.

Harbour lights.—A *fixed green* light is shown from the west end of the coal depôt; and a *fixed red* light 300 yards to the southward of it. These lights should be visible in clear weather from a distance of about 3 miles, and are not seen until a vessel is eastward of the line of the breakwater; kept in line bearing S. 6° W. they lead (parallel with the direction of the breakwater) midway between the second and third lines of buoys.

Three *fixed green* lights are also shown from the extremity of the landing pier.

PILOTS.—A pilot-boat, displaying a jack on a staff in the bow, boards vessels (except native craft), standing for the port, about one mile outside the breakwater. Pilotage is compulsory for all merchant vessels above 200 tons. At night pilots board steamers showing a blue light, but not sailing vessels. The pilot-boat shows a flare-up light occasionally after rounding the head of the breakwater.

Night Pilot Signals.—The following signals are shown at night from the Pilot's look-out tower, near the flagstaff, in answer to signals for a pilot made by vessel approaching the harbour :—

One blue light: signifies that the pilot on night duty is disengaged, and will proceed at once to the vessel making the signal.

One red light: that the pilot is engaged with another vessel, and will go off as soon as possible.

Three blue lights in succession, with a short interval between: that a pilot will not go out, the weather being too bad for safely boarding a vessel at night; an event, however, which seldom happens. Under such circumstances a vessel should either anchor well out, or keep underway until daylight.

DANGERS.—Drunken Sailor, a ledge of rocks with 7 feet least water, bears W.S.W. from Colombo principal lighthouse, and lies nearly half a mile off shore. On this danger, during the south-west monsoon, the sea breaks, but not during the north-east monsoon, or with smooth water.

See plan of Colombo harbour, No. 914.

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A black buoy is moored during the north-east monsoon, from October 15th to April 15th, about half a cable westward of Drunken Sailor. Vessels should always pass to the westward of this buoy.

Tartar rock, a sunken rock, with 21 feet water over it, lies about 6 cables northward of Drunken Sailor, and N.W. half a mile from the flagstaff.

A red buoy is moored about half a cable to the north-west of Tartar rock. Vessels should not pass less than half a cable westward of this buoy.

Tides and Currents.—It is high water, full and change, at Colombo at 1 h. 50 m. Springs rise about 2 feet, and neaps only a few inches. In the south-west monsoon, when the mean level of the ocean is the lowest, the difference between the high and low water is from 5 to 15 inches. On those days when the difference between high and low water is not more than 6 inches, the rise and fall has been observed to take place four times within twenty-five hours.

The current off the west coast of Ceylon is variable about the change of monsoon; during the south-west monsoon it sets to the northward, and when the north-east monsoon is fairly set in, from the end of November to the middle of February, it sets southward. Its strength is not more than one knot an hour.

Colombo roadstead, although exposed to the south-west monsoon, is safe for vessels well found in ground tackle, but since the completion of the breakwater it is seldom used, except by vessels seeking cargo. Communication between the shore and shipping is seldom interrupted, although there are occasional spells of squally weather and a high sea during the south-west monsoon.

Anchorage.—The anchorage outside Colombo harbour is with the lighthouse at the extremity of the south-west breakwater bearing E. by S., and the principal lighthouse S.S.E. $\frac{1}{2}$ E., in 8 to 9 fathoms, good holding ground.

Ballast.—Vessels are not allowed to discharge ballast in depths under 12 fathoms near Colombo.

COLOMBO HARBOUR is sheltered from the south-west monsoon by the breakwater, within which there are moorings for vessels of any size. This port is of increasing importance, and all the foreshore is being extensively reclaimed.

The Breakwater (south-west), the foundation stone of which was laid by H.R.H. the Prince of Wales on the 8th December 1875, is carried out from near Battenberg point in a N. $\frac{5}{8}$ E. direction for about

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See plan of Colombo harbour, No. 914.

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three-quarters of a mile. The breakwater encloses an area of about 500 acres, which is being dredged to a depth of 28 feet at low water, and a few berths are available for vessels of that draught.

A breakwater is in course of construction off the western side of Mutwal point, and the works at present extend 633 yards S. 82° W. from it. It is proposed to continue the same in the direction of the main breakwater, leaving an entrance 750 feet in width between the pier heads.

Moorings.—Four lines of moorings, with six buoys about one cable apart in each line, are laid down parallel to the main breakwater, affording 24 berths for large vessels. The pilots berth all vessels, mooring them head and stern, head to northward during north-east monsoon, when the spaces between each tier of buoys serve as channels up and down the harbour; and head to westward during south-west monsoon, when the space between the second and third tiers of buoys from the breakwater is reserved as the channel, for which at night, the red and green leading lights in one, serve as the leading mark.

DIRECTIONS.—Vessels approaching from the westward should bring the lighthouse at the extremity of the breakwater, or *red* light, to bear E. by S., and then steer towards it. From the southward, when near Colombo, keep about 2 miles off shore, or in a greater depth than 14 fathoms, until the breakwater light bears eastward of N.E. by E., when Tartar rock will be passed, and course may be altered towards the harbour entrance.

The signal for a pilot should be made when about 3 miles from the port, but at night a vessel should stop in the position recommended for anchoring in the roadstead, if not previously boarded by the pilot. Sailing vessels are not taken into the harbour at night, and should anchor in the roadstead until daylight. *See* Night Pilot Signals, page 95.

COLOMBO, the capital of Ceylon, has two quarters, the part known as the Fort, inhabited by the officials and merchants, occupying the point southward of the breakwater; and the portion inhabited by Sinhalese, Mohammedans, and Tamils, stretching along the shore eastward of the harbour. The streets are lined with avenues of hibiscus and other trees. The population of Colombo (1891) is 126,926.

Communication.—Steam, Railway, Telegraph.—Colombo has weekly communication with the United Kingdom and Australia by the mail steamers of the Peninsular and Oriental, and Orient companies, the services alternating. The P. and O. Co. provide fortnightly steamers to and from Japan, China, Straits Settlements, Calcutta, Madras, Colombo, and Bombay. There is communication by several other lines of steamers with Europe, India, Australia, and China. Colombo is connected by railway

See plan of Colombo harbour, No. 914.

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with Kandi, about 60 miles to the north-eastward; and with Galle and Madura to the southward By telegraph, with the Indian system, and Galle, Kandi, Trincomali, Batticaloa, &c., in Ceylon.

Supplies.—Fresh water is brought alongside in tanks. Beef, mutton, and vegetables are plentiful, can be obtained in any quantity, and are of moderate price.

Coal.—About 100,000 tons are kept in stock. It is shipped in bags, from lighters of 15 to 20 tons capacity, with rapidity, and bad weather causes no interruption; about 100 tons per hour can be placed on board.

Repairs.—Large repairs can be executed, boilers of any size made efficient, shafts of 9 inches diameter forged, cylinders of 60 inches diameter cast and bored, and engines of any size put in order. The crane on Government wharf, which has a depth of 4 feet alongside at low water, has a lifting power of 15 tons.

Time Signal.—A time signal is made daily, except on Sundays and public holidays, at a flagstaff adjoining the Master Attendant's office. The signal is a red and white semaphore, inclined at an angle of about 45° as preparatory at five minutes before signal, placed horizontal at two minutes before, and dropped at 4 h. 15 m. p.m. Madras mean time, equivalent to 22 h. 54 m. 0.6 s. Greenwich mean time.

Position.—The Master Attendant's flagstaff is situated in latitude 6° 56′ 35″ N., longitude 79° 50′ 35″ E.

Trade.—Shipping.—The chief exports are tea, coffee, chinchona, cocoa-nut oil, coir, &c.; the imports, grain, spirits, wine, sugar, tobacco, cotton manufactures, &c. The port was entered in 1896 by 2,264 vessels of 3,081,263 collective tonnage.

Quarantine.—Vessels with an infectious disease on board, or having occurred on board within 10 days previous to arrival, are placed in quarantine, for a term to be decided by the principal civil medical officer.

Hospital.—Seamen are admitted to the general hospital at Maranda. There is no sailors' home at Colombo.

Winds and Climate.—A moderate gale of wind is sometimes felt at Colombo about the change of monsoon in May or June, or November, and occasionally in December. In January the north-east monsoon is at its height, and from noon to sunset the "alongshore" wind, dry and considered unhealthy, is experienced. Towards the end of the month slight showers fall. February is dry, with hot days and cool nights. Land and sea breezes set in towards the end of the month. In March there are squalls off the land, with thunderstorms in the evening. In April land and

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See plan of Colombo harbour, No. 914.

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sea breezes prevail; about the middle of the month south-west winds usually blow for a few days, this is known as the little monsoon; a ground-swell from the south-west sets in at the end of the month. About the middle of May the south-west monsoon begins with a burst, which is violent for a few hours, but soon settles down into a steady wind with copious rain. In June the monsoon is stronger, and in July more moderate again, with the rainfall abating in quantity. August and September are fine with light westerly winds. October is more unsettled, with the wind inclined to the northward. Early in November the wind is north-west by day and north-north-east at night, and about the middle of the month the north-east monsoon begins with more or less disturbed weather, and heavy rain again falls. In December the monsoon is steady and moderate, and the "alongshore" wind is felt.

The following table is the result of observations taken at Colombo at an elevation of 40 feet above sea level :—

Month.	Temperature.					Humidity.	Cloud.	Rainfall.		Barometer.	
	Mean.	Mean Maximum.	Mean Minimum.	Mean Range.							
				Daily.	Month.	Mean.	Mean.	Inches.	Days.	Mean.	Daily Range.
	°	°	°	°	°	°				in.	in.
January - -	79	86	72	14	21	74	4·9	3·0	6	29·88	0·12
February - -	80	87	73	14	22	73	4·2	2·0	4	29·88	0·13
March - -	82	88	75	13	18	76	4·7	5·0	9	29·87	0·13
April - - -	83	89	77	12	18	77	5·6	10·9	13	29·82	0·12
May - - -	83	87	78	9	18	79	6·8	13·0	20	29·81	0·10
June - - -	82	85	78	7	14	81	7·6	7·6	17	29·82	0·08
July - - -	81	85	77	8	14	80	6·8	4·9	12	29·83	0·08
August - -	81	84	77	7	13	80	7·0	3·9	13	29·84	0·09
September - -	81	85	77	8	13	80	6·9	5·2	14	29·86	0·11
October - -	81	85	76	9	15	80	6·8	14·1	21	29·86	0·11
November - -	80	85	74	11	16	79	6·2	12·3	17	29·86	0·11
December - -	80	85	73	12	19	76	5·9	6·3	13	29·87	0·12

The Coast, from the mouth of Kalaniganga river, lying half a mile north-east of Mutwal point, runs northward nearly straight towards

See chart, No. 68*b*.

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Negombo, and is low, sandy, and fringed with cocoa-nut trees. It is free from outlying dangers, and the soundings shoal gradually towards the shore.

NEGOMBO POINT, situated 16 miles northward of Colombo, is prominent, and covered with cocoa-nut trees; it has a narrow rocky ledge, with 3 and 4 fathoms upon it, extending 3 miles, N. by W. ½ W., from the point, and terminating in a coral patch upon which is a depth of 1½ fathoms. Negombo is connected with Colombo by a lake, 5 miles in length, which has at its south end the entrance to a canal.

Anchorage.—Small craft may anchor northward of Negombo town, inside the ledge, in 3½ fathoms, half a mile off shore. Large vessels should anchor about one mile west of the rocky point in about 7 fathoms, but not during the south-west monsoon.

Kemel River entrance is 4 miles northward of Negombo, and causes a break in the line of cocoa-nut trees which fringe the shore. From hence the sandy coast stretches almost straight northwards for 18 miles to Chilaw, upon which are many villages.

CHILAW TOWN,* in latitude 7° 34′ N., longitude 79° 47′ E., is on the east bank of a narrow estuary that runs very near the coast, and has a common mouth with Dedruoya river at Chilaw point. A bungalow with a red-tiled roof stands on the shore opposite the town. Chilaw point, 2 miles north of the bungalow, may be known by a sand-hill and a round hummock near it.

Anchorage.—Vessels may anchor near the mouth of Chilaw estuary, one mile off shore in 6 fathoms, with the point bearing S.E. A vessel approaching Chilaw river from the southward should keep 4 or 5 miles off shore, and haul in towards the land as Chilaw point is neared. There are some rocks partly above water, three-quarters of a mile off shore, 5 miles north from Chilaw bungalow.

KALPENTIN ISLAND is a narrow strip of land forming the coast for 40 miles northward from Chilaw point, its southern tip being at the mouth of Dedruoya river. The island is low and sandy, and its desolate shore trends generally in a north-by-west direction 32 miles, thence north 5 miles to its north-west point, when it turns to the north-east for about 6 miles. Trees exist only by the villages, of which there are few. Putlam lake and the backwater southward of it separate Kalpentin island from the mainland of Ceylon.

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* A vessel lies sunk in a depth of 8 fathoms, with the foremost head, painted white, showing above water, in a position about 8 miles westward of Chilaw. Approximate position, latitude 7° 34′ N., longitude 79° 39′ E.

See chart, No. 68*b*.

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The town of Kalpentin lies on the east side of the island, 1½ miles from its north-east point, and boats have access to it by passages, south and east of Mutwal island.

Putlam is a large town on the mainland, near the south-east corner of the lake of that name, from which the sea is 6 miles distant.

Directions.—Vessels passing Kalpentin island should keep 7 miles from the shore, as near its middle part a rocky flat extends for 5 miles (to one mile within the edge of the bank of soundings), upon which are depths of 3¼ and 4 fathoms.

Mutwal island, 7 miles in length, lies northward of Kalpentin island, and between its north end and Karativo island is formed Dutch bay, where small craft can obtain anchorage, and find shelter from south-west winds.

A rocky patch, with 2¾ fathoms upon it, 2 miles off shore, lies 3½ miles S.W. by W. from the north point of Mutwal.

A coral shoal, 2 miles long, partly awash, lies in the approach to Dutch bay, with its south end 2½ miles W. by N. ½ N. from Mutwal north point.

KARATIVO ISLAND, the north extreme of which is 19 miles N. by E. ½ E. from the north-west point of Kalpentin island, is a low narrow strip with some sandy hillocks upon it, 12 miles long, lying nearly parallel with the mainland, from which it is distant about 3 miles. There is a channel inside the island, in which is a depth of 9 feet, where shelter may be found by coasting craft in south-west winds.

Rocky banks, with depths of 2 and 2¾ fathoms upon them, extend 2 to 4 miles westward of Karativo, the outer limits of which are but 2 to 3 miles inside the edge of the bank of soundings; north of the island, patches with depths of 2¾ and 3½ fathoms continue for 9 miles. A good offing should be preserved in passing Karativo island.

Directions.—It is not advisable to close the coast on the Ceylon side of the Gulf of Manar above Karativo island. The patch of 3½ fathoms 9 miles north of the island is 11 miles from the mainland, and further north the ground inside the 5-fathoms contour line, which is about 9 miles offshore until westward of Manar island, is generally foul, and contains numerous shallow rocky patches.

Kodramalai point, in latitude 8° 32′ N., longitude 79° 51′ E, is on the mainland, 4½ miles, E. by N. ¾ N., from the north end of Karativo. The point is steep and rocky with three long hills south of it, that are seen over the lowland of Karativo. From Kodramalai the coast trends north-eastward 4 miles to Moderegam point, forming a bay; thence more northerly for 8 miles to Condachi.

See chart, No. 68*b*.

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Anchorage for small vessels may be obtained in 2½ or 3 fathoms, sandy bottom, northward of Kodramalai point, at about one mile from the shore.

Condachi, a village on the sea-coast 7½ miles northward of Moderegam point, is midway between that point and Aripo river mouth. Kalar river lies 3 miles south of Condachi, and the sandy shore between it and the Aripo river is at times the resort of a large number of people engaged in pearl fishing. Mounds of oyster shells, the accumulation of ages, are raised along the shore.

North-westward 2 miles from Condachi are several dangerous rocks.

ARIVEAR or ARIPO RIVER falls into the sea by several mouths north of the village of Aripo. The outer point of its delta is 7½ miles north-north-west from Condachi village, and from it the coast trends about north for the same distance to the island of Manar, forming a bay which has a depth of about 2 fathoms. The most conspicuous landmark on this part of the coast, standing half a mile south of Aripo village, is a residence for the governor of Ceylon, called the Doric.

The Pearl banks are outlying shoals that extend several miles off the shore between Condachi and Manar island, on approaching which from seaward the Doric appears in sight before the cocoa-nut palms or the houses of Aripo and Condachi.

The pearl divers are chiefly Tamils and Moors, who ordinarily remain under water less than a minute, and never exceed a depth of 13 fathoms. The diving appliance consists of a stone about 30 pounds weight, and a network basket for the oysters.

MANAR ISLAND, which is separated from Ceylon by a narrow boat channel, extends north-westward about 15 miles; its western end bears north 53 miles from the north-west point of Kalpentin island.

The seaward face of the south-east part of the island has low sand-hills for about 5 miles; at the western end are abundance of cocoa and other palm-trees near the villages. Very large baobab trees grow here, some of 30 feet circumference.

The town of Manar, surrounded by cocoa-nut trees, is situated at the east end of the island, near the narrow strait; the place has greatly declined in importance. Population in 1891 was 3,254.

Manar port, near the south-east end of Manar island, affords shelter for small vessels; it has a south bar and a north bar, where custom-house officials board ships entering.

The bank of soundings extends about 22 miles to the south-west of Manar island, and the Pearl banks for 9 miles in the same direction.

See chart, No. 68*a*.

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ADAM'S BRIDGE.—This barrier is a ridge of sand and rocks, mostly dry, about 1½ miles in width, forming the head of the gulf of Manar; and with the islands of Rameswaram and Manar, it nearly connects Ceylon with the continent. It extends from the west point of Manar island, about W. by N., 16 miles, and is for the most part composed of shifting sand-banks with narrow intricate channels between them, in which the depths vary and may be about 3 or 4 feet at low water.

In the south-west monsoon a strong current sets northward over Adam's Bridge, which abates to the westward as the Indian coast is neared; a confused sea generally prevails near Manar.

The edge of the bank of soundings is 12 miles to the south-west of Adam's Bridge.

RAMESWARAM ISLAND, lying between Adam's Bridge and the south-east cape of Hindustan, is low and sandy, and well planted with cocoa-nut trees towards its west end. From the village of Thani Kodi at its east extreme, 16 miles W. by N. ½ N. from Manar, the west end of Rameswaram bears N.W. by W. ½ W. 14 miles. The island is 4½ miles wide near the middle, but its eastern part is merely a narrow strip of sand.

A great temple with majestic towers, 120 feet in height, stands on rising ground on the north part of the island in an enclosure 1,000 feet long and 650 feet broad, which is entered by a gateway 100 feet high; it is visited by large numbers of pilgrims from all parts of India.

On the eastern side of the island, south-east of the temple, stands the town of Rameswaram, south-west of which is a great fresh-water lake.

The town of Pamban is at the western end of the island.

Kundugal point, the south-west point of Rameswaram island, between which and Shingle islets is the south-eastern channel to Pamban pass, bears S. ½ E. nearly 2 miles from Pamban lighthouse. The extreme point, which is marked by a beacon, is low and sandy, but cocoa-nut plantations commence a short distance from it, and extend northward and north-east.

Eastward of Kundugal point the coast is backed by low sand-hills covered with scrub and stunted bushes. A white beacon, 2 miles eastward of Kundugal point, marks the eastern limit of the port of Pamban.

Buoy.—A black buoy is moored at the edge of the shoal extending from Kundugal point.

LIGHT.—A *fixed white* light elevated 97 feet above high water, and visible 12 miles in clear weather, is exhibited from a circular column of masonry, situated on a sand-hill about 40 feet in height, on the north-west

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See chart, No. 68*a*, and plan of Pamban pass, No. 69.

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point of Rameswaram island, and three-quarters of a mile eastward of Pamban pass.

Toniturei (Ramen) Point.—This narrow tongue of land is the south-eastern point of Madura on the Indian coast, and is rather more than one mile west of Pamban town. Toniturei temple stands 300 yards within the point.

Kathu Vallimuni reef lies off the north shore of Toniturei, and is 1¾ miles in length east and west, and 3½ cables broad; it consists principally of large patches of coral and rock, with several feet of water between them, and dries in parts at low-water spring tides. There is a boat channel about half a cable broad between this reef and the mainland.

Kanthe Thuki reef, 2½ to 4 cables westward from Pamban lighthouse, is composed principally of coral patches which partially dry at low water. There is a boat channel between the reef and the shore, used by pilots when boarding vessels in the north-east monsoon.

PAMBAN PASS is the channel between the west end of Rameswaram island and Toniturei, and it is of great advantage to the native coasting craft trading between the west coast of India and Manar gulf, and the east side of the peninsula and Burma ports. It is also used by the small coasting steamers of the B. I. S. N. and Ceylon steamship companies; these vessels of from 200 to 500 tons and about 200 feet in length are quite as large as can be safely navigated.

The narrow part of the channel, at the cutting through the reef, is 200 feet wide; the maximum draught of vessels using the passage is 11½ feet, in a few instances steamers drawing 12 feet have been taken through at the top of exceptionally high spring tides, and in calm weather. The channel in one part is continually silting up owing to the very strong currents, which at the height of the monsoons sometimes run at the rate of 6 or 7 knots. The pass is not adapted for long vessels, and is rarely used by strangers, who, when intending to proceed through, should telegraph to the port officer. It is a dangerous place for a stranger to approach from the southward at night, on account of the low, outlying islands, surrounded by coral reefs, which have deep water close to their edges.

The principal rocky barrier through which the pass has been made extends in a nearly straight line from Toniturei point to Pamban. On the west side of the pass it is named the Great dam, and consists of large masses of rock, having a flat surface, which were formerly portions of a causeway that extended from Rameswaram island to the mainland. The north face of the dam at low water is steep-to, and presents a wall-like

See plan of Pamban pass, No. 69.

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appearance, but the boulders are sufficiently separated to allow a free passage to the water at low tide.

About 100 yards south of the Great dam, and parallel to it, is another rocky ridge termed the South dam, which shows partially at low water and extends half-way from the pass to Toniturei point. Eastward of the pass is a ledge of rocks, evidently once a continuation of the Great dam; it is covered at high water, and there are several patches of rock to southward of it with varying depths of water between. At $1\frac{1}{2}$ cables from Toniturei point, there is an opening in the rocks; it is, however, so small, and has such a rush of water through it, that even fishing canoes never attempt to pass through.

Buoys.—The northern entrance to the pass is marked by a chequered buoy; moored with the lighthouse on Rameswaram E. by S. $\frac{3}{4}$ S., distant $6\frac{1}{3}$ cables, and the Pamban pass ball and tripod in line. A red buoy is moored in the middle of the pass; and the sides of the channel are marked by posts.

Directions.—The approach from the northward to Pamban pass is clear of dangers; the land, however, in its vicinity is low, the only conspicuous object being the temple of Paruvadum, on the northern part of Rameswaram island. This is the first object seen from seaward, and is a good guide for making the port; on a nearer approach to the entrance the lighthouse forms an excellent mark. The tripod and pass ball in line, near the eastern end of Great dam, lead to the entrance of the pass.

At night vessels may steer for the Pamban passage, with Pamban light (visible 12 miles) bearing from S.W. to S.S.E. During the strength of the north-east monsoon (early in November to end of January) Pamban passage should not be approached at night, it being then unsafe to anchor, owing to the short chopping sea which prevails.

Anchorage.—Vessels may anchor north of the Pass in 20 to 23 feet water with the lighthouse bearing S.E. to E.S.E., distant about one mile, and Toniturei temple S.W. The holding ground, mud, is very good.

PAMBAN TOWN, situated on the western extreme of Rameswaram island, consists principally of large-sized huts. There are only two European families here, but of late years, as traffic through the pass has increased, many native merchants have established themselves at Pamban. The inhabitants are for the most part fishermen and boatmen, some of whom find employment in conveying coolies to Ceylon, and others in ferrying the pilgrims who visit the temple of Rameswaram; there are also a large number of coolies employed in hauling vessels through the pass when the wind is adverse, sometimes as many as a dozen vessels being hauled

See chart, No. 68*a*, and plan of Pamban pass, No. 69.

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through in one day. The number of coolies annually passing through Pamban averages about 26,600.

Population.—The population of the town numbered 3,420 in 1898, of whom two-thirds are Mohammedans, and the remainder Hindus. The only Europeans, are the port and immigration officers with their families.

Communication.—An occasional steam vessel runs to Negapatam and Colombo. Pamban is connected with the telegraphic systems of India and Ceylon.

Repairs.—There are no docks or means at Pamban for the repair of vessels.

Supplies of every description are scarce, except firewood and fish, which are plentiful. Water of good quality is easily procurable. No coal available.

Trade.—Shipping.—The exports are not important, they consist of dried fish, salt, cocoa-nuts and fibre, coral, firewood, and cattle, valued (1897) at Rs. 36,550. The imports are paddy and other grain to the amount of about 6,600 tons, valued at Rs. 347,361. About 1,400 native coasting vessels of 91,000 aggregate tonnage pass through the canal yearly; also 118 coasting steamers of 51,000 total tonnage.

Pilots.—The licensed pilots at Pamban are under the orders of the Master Attendant. During the south-west monsoon pilots are stationed on Pulli island, to look out for vessels making Pamban from the southward.

Pilotage for Pamban channel is charged on a sliding scale per foot, from a draught of 3 feet and under to 12 feet; between 7 and 8 feet, $1\frac{1}{4}$ rupees; between 11 and 12 feet, $3\frac{1}{3}$ rupees per foot. For Kilakari channel, the pilotage charge is at the rate of 10 annas per foot.

Hospital.—Seamen are admitted to the civil hospital.

Horse-shoe bank.—Southward of Pamban pass is an extensive sand-bank, which, projecting from the west end of Rameswaram, bends round in the form of a horse-shoe to Toniturei point; the general depths over it are from 2 to 6 feet, and through the loop, at $1\frac{1}{4}$ miles from the pass, Sand-bank channel has been dredged to the depth of 10 feet at low water. A red buoy lies at each end of this channel. The beacons on Kurisuddi island and reef in line, lead through.

Pulli, Pullivausel, and Kurisuddi are three islands southward of Horse-shoe bank, which are completely encircled by Pulli coral reef, the whole forming a natural breakwater that protects the pass and the channels leading to it from the swell of the south-west monsoon. The northern edge of the reef is clearly defined at low water, but its southern

See plan of Pamban pass, No. 69.

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edge is much broken into patches, and the sea breaks continually over it. The islands are low and covered with scrub and bushes.

Pulli is the pilot station; it is marked by a beacon 30 feet high and painted white.

Kurisuddi, also marked by a beacon, is used as a quarantine station, and has a hospital and a few small houses on it. The space between the northern edge of the reef and Pamban pass, forms a sheltered anchorage for vessels of light draught in all weathers.

Puma East Channel, between Pulli reef and Horse-shoe bank, is marked at its western entrance by two buoys 3 cables apart; the buoy near the reef is black, the other red. A depth of 3 feet at the eastern end of Puma east channel is marked by a post.

Shingle islets, two small islets $1\frac{1}{3}$ miles south-east from Kundugal point, are low, and have a few bushes and shrubs on them. A large beacon 40 feet in height, painted white with a black mark, erected on the eastern islet, is a good guide to vessels making for the eastern entrance channel. Kallaru reef surrounds the islets, extending one cable eastward, and $3\frac{1}{2}$ cables westward and north-west of them. It is composed of coral, and the sea breaks heavily on its south-west edges.

SOUTHERN DANGERS.—A two-fathoms patch lies 4 miles S. by E. from Shingle islets, the sea breaks on it with a fresh breeze; the east port-beacon just open eastward of the beacon on Shingle islet, about N.E. by N., leads westward of it. About $2\frac{3}{4}$ miles E. by S. $\frac{1}{4}$ S. from this patch, there is another, having 3 fathoms over it.

A patch of rock lies to the southward of Kurisuddi island, with Pamban flagstaff and Kurisuddi beacon in line, distant one mile from the latter, and has a depth of 7 feet on it. Another rocky patch, with 8 feet over it, lies midway in the channel between Kurisuddi island and the north-west part of Kallaru reef. This passage is seldom used, as the bottom is foul and uneven, and, occasionally, heavy breakers extend the whole breadth of the channel.

Pulli Shoal, $1\frac{1}{2}$ miles S. by E. $\frac{1}{2}$ E. from Pulli beacon, is composed of sand and coral; the general depths on it vary from 8 to 12 feet, but on its north-west part is a rocky patch with only 5 feet water over it. The western edge of this shoal lies almost due south of Pulli beacon. With a moderate breeze the sea breaks on the shoal.

Manauli islet, lying 7 miles south-westward of Pamban light-house, is the easternmost of a number of islets, which, with their fringing reefs and intervening banks, lie at some distance off the Madura shore between Tonitурei point and Tuticorin, thus sheltering a

See chart, No. 68*a*, and plan of Pamban pass, No. 69.

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considerable extent of the northern waters of the gulf of Manar from the swell of the south-west monsoon, and affording convenient smooth water navigation for the coasting craft. A small white beacon, 15 feet high, stands at the eastern end of Manauli islet.

At 1¼ to 2 miles southward of the reef encircling Manauli and Musel islets are several shoals having 2½ to 3 fathoms water over them. One of these shoal patches, with 2½ fathoms water, lies 2½ miles southward from Manauli, and 3 miles eastward from the southern elbow of the reef.

Manauli reef, extending 2 miles east of Manauli islet, is about 7 cables broad, and consists principally of coral and rocky patches; it dries at low-water spring tides.

INNER DANGERS.—Kana Paru reef is a coral patch 1½ miles westward of the south extreme of Pulli island; the whole surface dries about one foot at low water.

Kolimuruka reef, awash at low water, lies about 7 cables W.S.W. from Kana Paru reef, and nearly the same distance from the northern edge of Manauli reef.

Heron reef, nearly one mile due west from Kana Paru, is awash at low water.

May reef lies 4 cables north-east from Heron reef, and W.N.W. of Kana Paru; it is of small extent and is awash at low water.

Sunken reef.—This dangerous patch lies 1½ miles north-westward from Kana Paru reef, and about 1¼ miles S. by W. ½ W. from Mundapum point; it has about one foot on it at low water, and is not easily seen during rough weather.

Tides.—It is high water, full and change, at Pamban at 1 h. 48 m.; springs rise 3 feet. During neaps, sometimes for 48 hours, there is a range of only one or two inches.*

The tides are irregular at Pamban, the rise and fall being affected by the winds. During the north-east monsoon there is less water throughout the whole space southward of the pass, but in the south-west monsoon the reverse takes place, and the level of the water is higher or lower, according to the force and continuance of the prevailing winds.

The flood stream enters between Kundugal point and Kurisuddi island, and sets westward along the face of Pulli reef till it is joined by the stream setting in through Puma channel, thence it takes a northerly direction, but is weak except during strong winds.

* The tides are subject to a diurnal inequality, which may accelerate or retard the times of high and low water, sometimes to the amount of one hour or more, and increase or diminish the rise by upwards of one foot.

See chart, No. 68*a*, and plan of Pamban pass, No. 69.

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The currents of Pamban are generally influenced by the force of the wind. Through the pass the current frequently attains a velocity of from 5 to 6 knots, rendering it at times difficult to take even steam vessels through. During the north-east monsoon the current sets to the southward, and in the south-west monsoon to the northward. The only months in which a decided tidal stream is noticeable, are March, April, and October, when it generally sets for 6 hours each way.

DIRECTIONS.—When approaching Pamban from the southward caution is necessary, as the islands fringing the coast are very low, and there are no hills or conspicuous landmarks to guide the navigator; during the south-west monsoon a thick haze frequently hangs over and obscures these low islands.

The first objects distinguishable from seaward are Pamban lighthouse and the beacons on Pulli island and Shingle islet. On a sandspit off the eastern end of Manauli islet, 7 miles to the south-west of Pamban, there is a small white beacon; the reef off Manauli island extends 2 miles eastward of it.

Vessels making for Puma channel, between the island of Pulli and Manauli reef, should be guided principally by the eye, as the reef off Manauli is clearly visible; it has deep water one cable off it all round, and the sea always breaks on its south and east sides. Pass about 2 cables eastward of Manauli reef, and then steer to pass 2½ cables westward of Pulli reef. If bound for the pass, as soon as the beacon on Kunduga point is in line with the north-west point of Pulli island, haul in for the south buoy (black), which is moored off the north-west margin of Pulli reef, care being taken to pass close to the buoy, in order to avoid the 8-feet patch lying 3 to 4 cables W. by S. of it.

In making for Puma channel from the eastward, care should be observed not to shoal under three fathoms, so as to avoid Pulli shoal and the reef off Pullivausel, which extends 3½ cables from its south point.

In making for Kundugal channel, which is by far the best entrance, vessels should not shoal under 4 fathoms till Pamban lighthouse shows open eastward of Shingle islet beacon, when they may steer for the east port-beacon, being careful not to approach the reef off Shingle islets nearer than 3 cables. Vessels may haul in for the anchorage off Kundugal when the beacon on that point bears W. by N. ½ N. The anchorage is about 2 cables southward of Kundugal point, but care must be taken in approaching it to avoid the shoal ground that stretches 2 cables south-eastward of the point. Anchorage may also be taken more to the eastward in 19 to 23 feet water with the beacon on Shingle islet bearing between South and S.E.

See chart, No. 68*a*, and plan of Pamban pass, No. 69.

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Vessels approaching Pamban from westward, and passing between the islands and the coast of Madura, should, when abreast Manauli island, keep a good look-out for the reefs of Kolimuruka and Kana Paru, and steer in about mid-channel between them and Manauli reef. These reefs all show well, and have deep water close-to.

WINDS.—During October, south and south-west winds prevail and occasionally blow strong; towards the end of the month variable winds are experienced, which last until the early part of November, when the wind sets in steady from northward and eastward, and, with few exceptions, blows strong for the remainder of the month. The wind during December is much the same as that of November, veering, however, more to the northward, whilst heavy squalls of rain and wind are of constant occurrence. During January and February the north-east wind is more moderate; it is light in the morning, but sets in strong about noon as a sea breeze, and falls again at sunset. March is one of the finest months at Pamban, the north-east wind being light and variable. In the morning the wind sets in from eastward, having a tendency to shift to the southward, but by noon it backs to eastward, in which direction it lasts until sunset, when it gradually dies away. Occasionally south and south-west winds blow for a day or two, but the prevailing wind in March is from the north-east. April is a most uncertain month, the wind blowing from all quarters, no two days the same. Squalls of wind and rain are experienced, all tending to show the approaching change of monsoon. The south-west monsoon occasionally sets in during this month.

ISLETS and SHOALS.—From Manauli the chain of islets and shoals extend about W. by S. for 26 miles to Anapartivo. The soundings outside are tolerably regular with overfalls in places. About 4 miles S.S.E. from Muli islet, which is 9½ miles westward of Manauli, is a patch of 2½ fathoms with depths of 6½ to 8 fathoms close-to. Vessels should give these low islands a wide berth. No large vessel should shoal under 12 fathoms, or sight any of these low islands, except Manauli and Anapartivo.

Muttupetai Bay, with depths of 2½ to 5 fathoms, lies south-eastward of the town of that name, and to the northward of Muli islet, which is connected with Musel islet, 5 miles eastward, by a narrow 2-fathoms bank, over which, 1½ miles from Muli, is a depth across of 2½ fathoms at low water. This bay affords some shelter from the swell of the south-west monsoon.

Anapartivo is a small island encircled by a reef, and with shoal water extending one mile south-westward, which lies 2 miles eastward of Valinukam point.

See chart, No. 68*a*, and plan of Pamban pass, No. 69.

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VALINUKAM POINT, in latitude 9° 10½′ N., longitude 78° 39′ E., is on the mainland at the western entrance to the inland waters extending to Pamban pass; it is marked by a beacon tower, 20 feet in height, which is visible 10 or 12 miles.

The town of Valinukam lies on the northern shore of the point, about half a mile west of the beacon.

DIRECTIONS for the INLAND NAVIGATION.—These waters can be used by small vessels only, there being many shoals having a depth of but 6 feet, with narrow indefined channels, between them and other dangers.

Small sailing craft going westward from Pamban during the south-west monsoon will find the water much smoother inside the islands, but should obtain the services of a pilot, who can be discharged at Valinukam point.

If proceeding to Pamban by this route during the south-west monsoon, enter between Valinukam point and Anapartivo in mid-channel, where there is a depth of 3½ fathoms; pass half a mile off the north point of the island and then steer N.E. by E. about 6½ miles to the anchorage off Kilakari, being careful in passing the rock, marked by a beacon, off Yeravadi point, inside of which are reefs nearly awash.

From Kilakari to Pamban, 26 miles further eastward, pilots are usually employed; a vessel continuing from this anchorage without one should steer E.N.E. for nearly 2 miles, until the west extreme of Taliari island bears S.E. ¾ E., when steer direct for that point; or keep the two white beacons on the mainland in line, which lead over a flat in 2¼ fathoms. After the depth has increased to 4 fathoms, and when two bungalows (in ruins), westward of Muttupetai, bear N.E., resume course E.N.E. until the bungalows are abeam, when steer east direct for Puma channel, and look out for the shoals northward of Musel island.

Kilakari anchorage is in 2¾ fathoms, stiff mud, with a detached ruin, eastward of the town, north, and some large terraced houses about north-west.

Kilakari affords some facilities for the repair of small vessels.

Pilots for the inland waters and Pamban pass, are stationed here.

Nulla Tani Tivo is an island, one mile southward of Keelcaud point, lying 5 miles S.W. by W. from Valinukam point, 2 miles westward of which is Chullitivo islet, and 3 miles further west the small island of Upu tani tivo. Moekoer, a fishing village with a church, stands on the mainland, northward of Upu tani tivo.

See chart, No. 68*a*.

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There are pearl banks southward of these islands, and 3 miles E. ½ S. from the south end of Nulla tani tivo, a shoal patch upon which is a depth of 3¼ fathoms.

Vembar, a town at which is the boundary between the provinces of Madura and Tinnevelli, lies about 18 miles westward of Valinukam point; the intermediate coast, low, sandy, and well planted with palm trees, forms a considerable bight. Scattered shoal banks extend off this shore for more than 5 miles.

Vaipar, a village near the mouth of Vaipar river, lies 6½ miles S.W. ¾ W. from Vembar; off the intervening coast, depths under 3 fathoms extend nearly 5 miles, and there is a bank with 1½ fathoms upon it 5 miles east of Vaipar.

Chullitivo islets are three low sandy islets, lying about 4 miles S.S.W. of Vaipar, from which Tuticorin is distant 10 miles; small vessels can obtain anchorage between these islets. Nearly 5 miles westward of the southern islet stands the town of Putnurmadur, where are some large clumpy trees which are visible 9 or 10 miles off shore.

Between Valinukam point and Tuticorin large vessels should not approach the coast nearer than 6 or 7 miles, there being many scattered outlying shoals, some of which with depths under 3 fathoms.

TUTICORIN, the largest commercial town on the Indian shore of the gulf of Manar, is situated 8 miles south from Putnurmadur, and is the principal outlet to the large cotton-producing district of Tinnevelli. The land about Tuticorin is low and sandy, with palmyra trees near the town; a tall factory chimney, visible 12 miles, is conspicuous, and the various churches, as also the flagstaff near the landing jetty, will be seen on a near approach. The population in 1891 was 25,107.

Trade.—Shipping.—The chief exports are cotton, coffee, senna, oil cakes, chillies and onions, of an aggregate value in 1896 of 17,423,243 rupees. The imports are grains, spirits, hardware, hides, piece-goods, and betelnut, of an aggregate value of 5,739,591 rupees. In 1896 the port was visited by 1,859 vessels, of 465,526 total tonnage.

Communication by rail and telegraph exists with all parts of India. There is considerable native passenger traffic with Ceylon, and frequent communication by steamer with Calcutta, Bombay, and intermediate ports.

Supplies.—Water is derived from the Tambraparni river, and stored in wells and tanks; it gets polluted on the way, and the supply occasionally fails. The water is salt in local wells.

See chart, No. 68*d*, and plan of Tuticorin roadstead and harbour, No. 67.

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Coal.—About 1,000 to 2,000 tons are kept in stock by the South Indian Railway Company. Coal is shipped by lighters, each carrying from 10 to 15 tons.

LIGHT.—A *fixed white* light, elevated 85 feet above high water, and visible in clear weather a distance of 14 miles, is shown from an octagonal brown column on Hare island, 2½ miles E.S.E. of the post office flagstaff.

Tides.—It is high water, full and change, at Tuticorin, at 1 h. 28 m., approximate. Springs rise 3¼ feet, and neaps 1¾ feet. The tides are irregular, being influenced by the prevailing wind. The flood sets northward, and the ebb southward; through Devil point passage, the streams run 1½ knots an hour.

Outer Anchorage.—The anchorage in the roadstead is in 5 to 6 fathoms, with the lighthouse bearing from W.N.W. to W. by S., and distant from 2 to 2½ miles. The best holding ground is said to be at the southern part of this space. During August and September, when strong winds blow off the shore, vessels may anchor half a mile nearer in.

In the north-east monsoon vessels should give a good scope of cable, and always have a second anchor ready, as the sea breeze blows on to the reef.

In the south-west monsoon (middle of May to middle of August), the wind, though violent, is invariably from the shore, west to south-west, and the water is smooth.

Directions.—Vessels making this anchorage at night should steer (nearly) for the light on Hare island, with it bearing between S.W. by W. and N.N.W., so that it may bear from W. by S. to W.N.W., at a distance of 4 miles; anchor in not less than 6 fathoms.

The Harbour, with depths of 11 to 7 feet, sand and mud, is formed by three low islands, and several shoals, lying parallel with, and about 2 miles from the shore.

There are two channels for small craft into Tuticorin harbour; in that between Hare island and Church island, which lies nearly 3 miles northward of it, there are the small pinnacle rocks, Kariapar, Velangupar, Seltive, and Sevandapar, with the Orripar reef, all marked by beacons. North screws chimney, bearing W. by N. ¾ N., leads in between Orripar reef and Kariapar rock in 10 or 11 feet, to the anchorage for small vessels, with the lighthouse S.E. by S., distant about one mile. This passage is said to be seldom used.

The southern passage is between Devil point and the long narrow islet of Punnayuddeethevu, lying south of Hare island, which are together encircled by a coral reef, three-quarters of a mile wide, extending 3½ miles southward from the lighthouse, and terminating in Muramshulli reef

See plan of Tuticorin roadstead and harbour, No. 67.

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(marked by a beacon). A small vessel entering by this channel should round Muramshulli reef at a distance of 6 or 7 cables, and steer for Devil point when it bears N.N.E.; pass through in mid-channel (one cable wide) between Devil point and the coral reef, and to the westward of Vattaipar beacon, on the rocks north-westward of Krangitivo. Thence the deepest water to the anchorage off Tuticorin lies about 1½ cables westward of Hare island and of Orripar reef. Two cables northward of Vattaipar there is a depth of only 6 feet at low water.

Devil point, about 1¾ miles S. by W. ½ W. from Hare island lighthouse, is a low sandy cape with sparse bushes on it, southward of which the shore is swampy and intersected by creeks.

Beacon.—A tripod beacon stands near the south extreme of Devil point.

Muramshulli reef lies 1½ miles southward of Devil point, and is completely submerged; it is marked by a screw-pile beacon with basket top.

GENERAL DIRECTIONS.—In the north-east monsoon, sailing vessels from the southward, bound to Tuticorin, should keep in sight of Ceylon until on the parallel of Kalpentin, whence they could fetch across to the former place.

From the western coast of Hindustan at this season, vessels should, after passing cape Comorin, keep the Indian coast aboard until up to Manapad point, then stretch over and make Ceylon, when they would probably on the next tack fetch Tuticorin.

In this monsoon, November to March inclusive, fine weather, with land and sea breezes, prevails on the Ceylon side of the gulf of Manar; and good anchorage may be obtained off the coast between Colombo and Chilaw in 6 to 9 fathoms, sand, at 2 to 3 miles from the shore.

During the south-west monsoon, all sailing vessels bound to Tuticorin should sight cape Comorin, and keep along the Tinnevelli coast. When leaving Tuticorin at this season, keep on the Indian side until near Manapad point, whence a vessel will generally fetch to windward of Colombo.

On the west side, and at the head of the gulf of Manar, great attention must be paid to the lead; vessels should not shoal to less than 18 or 20 fathoms when southward of Manapad, or to less than 12 fathoms when to he northward of it.

Currents.—The currents along the coast, outside the islands near Tuticorin, generally set with the wind, varying in strength from one to 1½ knots an hour. At the change of the monsoon they are weaker and variable.

[See plan of Tuticorin roadstead and harbour, No. 67.

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Penacoil, a small fishing village situated 1½ miles from the sea, is approached by a creek, the mouth of which is 9½ miles S.S.W. from Tuticorin lighthouse. It may be recognized by the ruin of an old church, and a scanty tope of palmyra trees on the beach. Penacoil peak lies about W. by N. from the village.

Anchorage may be obtained off Penacoil in 4 fathoms water, 1½ miles from the shore, with the tope of trees bearing W. by S.; sheltered in southerly winds by Coilnapatam reef.

A deep, 3 miles in length east and west, and one mile in breadth, lies off Penacoil anchorage, with its outer end 7 miles eastward of the tope of trees. The depths at this part are 15 to 20 fathoms, which shoal suddenly to 8 or 9 fathoms at the edge of the deep.

COILNAPATAM, a considerable town with a population of 11,000, lies 4½ miles south from Penacoil creek entrance. Coilnapatam point is 1½ miles northward of the town. The coast is sandy, with cocoa-nut trees, and there are some hills a short distance inland. A detached reef lies off the mainland, between which and the shore reef there is partial shelter for coasting vessels in 2 fathoms water.

Coilnapatam reef.—This dangerous reef has its northern extreme, with 10 feet water, at about 3½ miles N.N.E. ½ E. from the town; from whence foul ground extends, with the exception of a break off the village of Alendal, to Manapad point. The outer edge of the reef lies from 2 to 2¾ miles off shore, and over it in heavy weather a high surf rolls, breaking in from 2½ to 3 fathoms water. In ordinary weather the sea only breaks on an inner ledge, in 2 fathoms water, and less.

Many small passages exist between the rocks of the reef, only used by the small native trading craft; the channel inside is not good.

Pearl Banks.—From Coilnapatam northwards to Tuticorin, numerous pearl banks extend almost continuously, lying from 5 to 10 miles off the shore.

TIRUCHENDUR (Trichendoor) POINT, 4 miles from Coilnapatam, and 18 miles S. by W. of Tuticorin lighthouse, is a low, rocky, bluff headland, with a remarkable high dark-coloured pagoda on its extremity, which can be seen for a distance of about 15 miles. The town of Tiruchendur is situated half a mile westward of the pagoda, and 1½ miles northward near the shore lies Virandnapatnam, a town inhabited by fishermen of the Paravar caste.

Tiruchendur reef is a dangerous ledge projecting N.E. by N. 3 miles from the point, westward of which some shelter is afforded for

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See chart, No. 68*b*.

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small craft, in 1¾ or 2 fathoms water, off Virandnapatnam; the middle of the town bearing S.W. by W. ½ W. will lead between Tiruchendur and Coilnapatam reefs.

A rocky patch, with 4½ fathoms upon it, lies about 3 miles E.S.E. from the pagoda.

Alendal.—Southward of Tiruchendur point foul ground extends about one mile from the shore for 3 miles, at which distance stands Alendal village. Off this place good anchorage may be obtained in 4 fathoms, mud, with the church bearing W.N.W., distant 1¾ miles; here a vessel is protected, during south-west winds, by a reef to southward, which projects more than 3 miles from the shore.

Alendal shoals are two patches nearly 2 miles apart, lying off the village of that name, the northernmost of which, with 3½ fathoms upon it, being 5 miles E. ¾ S. from Alendal church. The south-western patch, one mile in length, has its least depth of 2 fathoms (near west end), 3½ miles S.E. by E. ¼ E. from the church.

Tiruchendur pagoda bearing N.W. by W. will lead to the northward of these shoals, and Manapad lighthouse bearing W.S.W. will lead clear to the southward of them.

MANAPAD POINT, situated 8 miles S.S.W. ¼ W. from Tiruchendur pagoda, is a high sandy promontory, based on rock, jutting boldly into the sea, and having a lighthouse and a church on its summit. The village of Manapad is three-quarters of a mile west of the lighthouse, and the town of Coilsinipatam 1½ miles north-westward from it. Off Coilsinipatam, and extending 4 or 5 miles to the north and east, is a great extent of foul, rocky ground, over which there are heavy breakers in the north-east monsoon; these breakers extend to about one mile south-east of Manapad point. A small patch, with 5 fathoms upon it, lies 2 miles S.S.E. from the lighthouse.

LIGHT.—On the summit, near the outer end of Manapad point, is a white masonry tower 27 feet in height, from which, at an elevation of 104 feet above high water, is exhibited a *fixed red* light visible in clear weather from a distance of 12 miles, between the bearings of N. 22° E., through west, to S. 22° W.

Manapad light will be altered to a *group flashing white* light, showing *two flashes* every *ten seconds*, elevated 140 feet above high water, and visible seaward in clear weather from a distance of 18 miles.

This light will be shown from a new white masonry lighthouse 60 feet in height, now constructing on Manapad point; and on the exhibition of the new light, which will probably be in 1899, the present light (fixed red) will be discontinued and the tower removed.

Approximate position, lat. 8° 22½′ N., long. 78° 3½′ E.

See chart, No. 628*b*.

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Anchorage.—Good anchorage in the north-east monsoon may be obtained in 6 fathoms, mud, within one mile of the shore, between Manapad and the town of Periathullay, lying 5 miles south-westward. From June to August, inclusive, when the south-west monsoon is strong, a heavy sea rolls in upon this part of the coast, and vessels then should anchor off Alendal or Penacoil.

MANAPAD OUTER SHOAL.—This extensive shoal, upon which are depths dangerous at all times to large ships, and for smaller vessels when there is much sea, lies from 4¾ to 8 miles south-eastward of Manapad point. The least depth upon it, 4 fathoms, lies close to the outer part of the shoal, 8 miles S.E. ½ E. from the lighthouse. E. by N., one mile, and W. by S. 5 miles from this position, is a depth of 5½ fathoms; 3½ miles N.W. of the same position is a patch of 4½ fathoms. The shoal within these limits is of triangular form, and close around it are depths of from 10 to 12 fathoms.

Manapad lighthouse and Tiruchendur pagoda are useful landmarks when passing inside this shoal. In thick weather give it a wide berth, and do not shoal under 18 or 20 fathoms.

The COAST from Manapad point trends in a south-westerly direction 20 miles to East cape, a prominent point one mile south of the village of Utaunkudi. Northward of Manapad the shore is low, but westward from that place, towards Comorin, it rises to the height of 100 or 200 feet in undulating sandy hills, with tall palmyra trees; the background is mostly of a reddish soil, covered with palmyra trees and bushes, and rising gradually to the foot of the Ghats, which, at cape Comorin, approach to within 3 miles of the shore. Numerous villages and small whitewashed churches line the coast, but landing in a ship's boat is at all times a difficult and dangerous operation.

Northward of East cape a bay is formed, where, in 4 fathoms, a small vessel may find some little shelter from westerly winds, and their accompanying swell, which is broken by the shore reef between Utaunkudi and Idingikari. The cape has trees on it, which abound to the north-eastward, amongst which, near the mouth of a small river, is Watakota fort.

The coast from East cape to cape Comorin forms in a deep bight, in which vessels find considerable shelter from westerly winds, but the swell caused by the south-west monsoon rolls round into it; and in that season no attempt should be made to land in a ship's boat. The boundary of Tinnevelli and Travancore states is situated about 5 miles north-east from cape Comorin.

See chart, No. 68*b*.

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Shoal.—The shore reef, between East cape and Idingikari, projects about a mile, and the 10-fathoms contour-line of soundings approaches to that distance from its edge.

In this vicinity (probably when close to the above reef), Captain Hope of H.M.S. *Thalia* saw breakers N.W. ½ W. three-quarters of a mile distant; cape Comorin (presumably the higher land inside it) bearing W. by S., extreme eastern land (probably East cape) N.E. by N. The soundings shoaled suddenly from 11 to 3½ fathoms.

See chart, No. 68*b*.

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CHAPTER III.

TRAVANCORE AND MALABAR COASTS—CAPE COMORIN TO MOUNT DILLI.
(Lat. 8° 5′ N., to lat. 12° 2′ N.)

VARIATION, 0° 30′ E. in 1900.

Sailing vessels bound to any port on the west coast of Hindustan, or to the Persian gulf during the north-east monsoon, from China, Australia, or the cape of Good Hope, should sight Ceylon, and make the coast of India near cape Comorin, thence hug the coast to profit by the land and sea breezes.

The COAST from cape Comorin trends W. by N. 14 miles to Muttum point, curves round north-westward for 65 miles to Quilon, thence continues about N.N.W. 205 miles to mount Dilli. From the village of Kumari to Alleppi the country belongs to the rajah of Travancore; thence to Paliport (with the exception of the port of Cochin, under the Indian Government) is the territory of the rajah of Cochin; northward of Paliport to mount Dilli is the British province of Malabar.

CAPE COMORIN, the southern extremity of Hindustan, is a low sandy cape, with a small white pagoda at its extreme point, north-west of which is the British resident's bungalow with a flagstaff. The village of Kumari, standing amongst cocoa-nut trees, and with high reddish ground at its back, lies half a mile north-eastward from the cape. To the westward of the pagoda the shore of the cape is sandy and barren; to the north-eastward it abounds with trees. It is proposed to build a lighthouse on this cape.

Off the south-east extreme of cape Comorin are three rocks on which the sea breaks, and outside of them foul ground extends to three-quarters of a mile from the shore. With a scant wind caution must be observed by vessels passing close to the cape, as the current sets rapidly round it, and they may otherwise drift into danger.

Aspect.—To the northward of cape Comorin the land rises in a gradual slope, so that when seen from a distance it has the appearance of being a high sandy promontory. The nearest mount, of a sharp conical form, with its summit 1,403 feet above the sea, is 4 miles north-west of the

See charts, Nos. 751 and 827.

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pagoda, and stands separated from the range of the Ghats, which rise northward of it in sharp peaks. This ridge attains heights of 3,140 feet at 7 miles (Camel's Hump), and 5,419 feet at 13 miles (Mahendragiri) from Conical hill, for which these peaks have been mistaken by vessels at a great distance.

Tides.—The flood sets eastward and the ebb westward off cape Comorin, but the direction and strength of the streams are much affected by the ocean currents. It is high water, full and change, at 0h. 30m. The rise and fall is small in amount and irregular, but may average 2 feet.

Wadge bank, of small extent, with 14 fathoms least water, and 26 to 44 fathoms close around, lies on the bank of soundings, 36 miles S.W. from cape Comorin.

Manargudi, situated 4 miles west of cape Comorin, is a small seaport, having at the back of the town a small lake that discharges itself into the sea during the rains, but which in the dry season is closed.

MUTTUM POINT, 10½ miles westward of Manargudi, is rather high, with steep cliffs of a very red appearance, and has a few trees near its extremity from which foul ground extends for 2 cables. A heavy surf prevails all along the coast between Comorin and Muttum, and only catamarans are used by the natives: no ship's boats should attempt landing. At 3 miles north-westward of the point, there is foul ground, with 1½ fathoms half a mile off shore.

LIGHT.—A *fixed white* light is exhibited on Muttum point, 300 yards from the sea, at an elevation of 141 feet above high water, from a granite column, 72 feet in height, showing black and white horizontal stripes from seaward. The light is visible when bearing from N. 65° W. through north to S. 85° E., and should be seen in clear weather from a distance of 16 miles.

Position.—Latitude 8° 7½′ N.; long. 77° 18′ E.

CROCODILE ROCK.—This dangerous sunken rock is a small pinnacle with depths of 15 and 19 fathoms close-to, lying S. 38° W., nearly 3 miles from Muttum lighthouse, and though showing sometimes above water, does not always break when the sea is smooth. At night, do not approach it under 25 fathoms water.

Adunda islet, 8 feet high, lies S.W. ¼ S., 1¼ miles from Muttum point lighthouse, and has foul ground extending 1½ cables from it all round. It is 1⅔ miles inshore of Crocodile rock in almost a direct line with the lighthouse.

See chart, No. 751.

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Kota islet, 12 feet high, lies W.N.W. $1\frac{1}{3}$ miles from Adunda islet. Foul ground extends south, east, and north-east from this small islet to the distance of half a mile, and N. by W. from it for 2 cables. From Kota islet Crocodile rock bears S. 9° E., and is distant nearly 2 miles.

Caution.—Vessels, unless for some adequate reason, should not pass inshore of Adunda and Kota islets; Adunda is difficult to distinguish from seaward.

KOLACHEL, situated about 5 miles N.W. by W. from Muttum point, and $4\frac{1}{2}$ miles southward of the remarkable round hill of Aunipauri, has several off-lying rocks above and below water extending about $3\frac{1}{2}$ cables from the shore. At the village of Kolachel troops sometimes embark in the fine season, the outlying rocks forming a partial breakwater, within which landing is comparatively easy.

Buoy.—A red buoy is moored a short distance south of the easternmost rocks.

Anchorage may be obtained in 11 or 12 fathoms water, one mile off Kolachel, with Aunipauri hill bearing N. by E., and the lighthouse on Muttum point E.S.E.

ENCIAM ISLET, situated 10 miles north-west of Muttum and lying about half a mile off the sandy shore, has a small building upon it; rocks, above and below water, project from the islet to the distance of half a mile north-west and south-west, close to which there is a depth of 11 fathoms. A little to the east of the islet the steep land near the sea has a red appearance; there are numerous patches of red land between Comorin and Quilon, but cocoa-nut trees fringe the greater part of the coast.

Vessels should be cautious when in the vicinity of this islet at night, as the depth of 20 fathoms is distant only about 2 miles from the rocks.

From Enciam islet, Colatur hill bears N.W. $\frac{1}{4}$ N., and is distant 8 miles.

COVELONG (Kovilam) POINT.—The coast from Enciam islet trends nearly straight north-westward $16\frac{1}{2}$ miles to Covelong. The shore between, except near Covelong, is sandy, fronted with cocoa-nut trees, and safe to approach. Covelong is low level land terminating in a bluff cape with a building upon it, close to the south-east of which are three points, and 3 miles further in this direction another point, where is the village and backwater of Karuchel.

TRIVANDRUM, in lat. 8° 29′ N., long. 76° 57′ E., is the capital of the independent state of Travancore, and the residence of the Maharaja;

See chart, No. 751.

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it is also the seat of the British residency. The town, situated about one mile from the sea, is of considerable extent, and had a population in 1891 of 27,877. The fort stands on ground 100 feet above the sea, and within its precincts is the Rajah's palace, a large handsome edifice in the European style.

Trivandrum observatory, with two white domes, 196 feet above the sea, stands on a hill 2 miles north of the town. The Rajah's palace at Shungamogum is a conspicuous building standing close to the water, westward of the fort. The coast is sandy, with cocoa-nuts and other palms.

Canals running along the coast enable Trivandrum to have direct communication with the great backwater system of northern Travancore and Cochin, and with the Madras railway.

Telegraph.—There is a telegraph office at Trivandrum.

Anchorage.—The shore is steep-to; vessels wishing to communicate should anchor half a mile from the shore in 12 fathoms, sand, with Pondera church (standing 1½ miles south-south-westward of the fort) bearing N.E.

Landing should not be attempted in ship's boats, for there is generally a heavy surf in the north-east monsoon.

Mountains.—Inland of Trivandrum the Ghats are of great elevation; Cuchy Mulla, the highest peak, 6,125 feet high, bears N.E. by E. ½ E., distant 21 miles from Pondera. Between this range and the coast there are lower hills, one of which, Naimum hill, is a regular sloping round mount elevated 600 feet above the sea. This hill is visible at a considerable distance from southward, and from Anjengo roadstead.

There are small white churches in almost every village along this coast.

ANJENGO.—Between Covelong point and Anjengo 20 miles north-westward of it, the land at the back of the cocoa-nut trees which fringe the coast, is hilly and undulating. As Anjengo fort and the few houses that are visible through the surrounding trees are low, this place is not easily distinguished from even a short distance. A church with a white front will be seen on the beach north-west of the fort, and a bungalow on the hills 2 miles north of it.

There is some red table-land about 4 miles northward of Anjengo which may assist in denoting the approach to the place. This, and similar pieces of table-land along the coast, being higher than the cocoa-nut trees, appear like red cliffs at the water's edge when seen from a ship's deck at a greater distance than 7 miles; the shore, however, is sandy from Covelong point to Quilon.

See chart, No. 751.

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Anchorage off Anjengo may be obtained one mile from the shore in 11 or 12 fathoms, sand and shell, with the flagstaff bearing about N.E. by E.; in depths under 10 fathoms the bottom is foul and rocky.

QUILON, in lat. 8° 53′ N., long. 76° 35′ E., is the third largest town of the Travancore state; it is also the headquarters for the military, whose cantonments lie east of the town. Tangacheri point, about one mile west of the town of Quilon, projects slightly beyond the coast south-eastward of it, and forms a bight; at about 5 miles south-east of the point there is a gap in the trees fronting the coast where an extensive backwater exists.

The beach near Quilon is steep and sandy as far north as Tangacheri cove, where rocky coast commences and extends around Tangacheri point to the northward, for a distance of 3 miles. Cocoa-nut groves grow close to the high-water line. A heavy surf breaks on the shore, and landing is at all times dangerous, except in native boats.

A rock awash at low water, with 7 feet around, lies 6½ cables S.E. by E. ½ E. from Tangacheri point.

A red conical buoy is moored about 3 cables south from the rock.

A reef, 3 cables in length, with a depth of 22 feet water upon it, lies south-westward of the coffee factory, parallel with, and one mile from, the shore.

A black conical buoy is moored close to its north-west extreme with the flagstaff bearing about N.E. ¾ N. and distant one mile.

These buoys are removed during the south-west monsoon.

Tangacheri reef is a bank of hard ground extending one mile south-west, and 2 miles west, from that point, at which distance from the shore the bottom is foul, with rocks above water in places, until 6 miles northward of the point. The bank is steep-to, and should not be approached into a depth under 17 fathoms at night.

The town of Quilon, situated near the sea-shore, contains a large bazaar and several Parsee shops. The Protestant church is to the east of the town, while along the banks of the coast canal, will be found the bungalows of the Europeans; the British residency is close to the backwater, north of the cantonment. There are many public buildings near the town; the post office and custom house are on the shore.

Tangacheri settlement, near the point, belongs to the British, there is here a Protestant burial ground amongst the ruins of old fortifications. A flagstaff has been erected at Tangacheri point.

Communication.—Quilon has continuous water communication by backwater and canal with Trivandrum to the southward, and northwards

See chart, No. 750, and plan on it, of Quilon road.

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to Alleppi and Cochin, thence to Shoranur, where connection is made with the Madras railway. The vessels of the British India Steam Navigation Company call here occasionally during the fine season. There is telegraph communication with all parts of India.

Trade.—The trade of Quilon appears to be increasing; the exports in 1882 were valued at Rs. 206,890 and imports at Rs. 768,827, the latter consisting chiefly of salt, tobacco, liquors, and metal. The principal goods exported were coffee, lemon-oil, salt fish, tamarind, cocoa-nut, timber, pepper, and nutmeg. The aggregate tonnage of vessels calling at the port in 1882 amounted to 38,649.

Population.—The population of the town of Quilon in 1875 was 14,366, inhabiting 2,877 houses. By the census of 1881, which was taken only by talukas (administrative sub-divisions) the Christian population in Quilon taluka was slightly in excess of the Mohammedan, and the Hindu about six times that of the Christians.

Supplies.—Food supplies of all kinds can be obtained: beef, mutton, vegetables, and fish are plentiful and cheap. No coal is procurable.

Winds.—At Quilon, during the period of the north-east monsoon, the prevailing winds blow from N.W. by W., veering to about W. by S. in February, and to N.W. by W. again, in May. Strong winds seldom blow from the southward. There are gales sometimes on this coast in April, May, and June, also in October and November.

Directions.—When approaching Quilon from the northward vessels should not shoal to less than 13 fathoms on nearing Tangacheri point, in order to avoid the foul ground extending westward from it. Thirovellarum church (white), 1½ miles north of Tangacheri point, shows well when bearing east, but a little north or south of this bearing is obscured by cocoa-nut trees. The Coffee Company's factory (building with red chimney), a large group of casuarina trees close south of the factory, and a high cocoa-nut tree further south, are the most conspicuous objects when making Quilon. When the high tree bears E. ¾ N. a vessel will be south of the dangers extending from Tangacheri point.

Anchorage.—The anchorage off Quilon is open to all winds from north-west through west to south-east, and is little frequented during the south-west monsoon, when communication with the shore is impracticable, except by signal. Vessels at this season should anchor in not less than 8 fathoms, and with Tangacheri point bearing nothing to the westward of north.

See chart, No. 750, and plan on it, of Quilon road.

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Between October and May, vessels can anchor off the factory. From the northward, enter between the buoys with the high cocoa-nut tree bearing E. ¾ N.; steer for the red chimney when it bears N.E., anchoring in 4½ fathoms sandy bottom, with Tangacheri point W.N.W.

Flagstaff.—A flagstaff, 75 feet high, belonging to the port department, has been erected in front of the factory, for communicating with vessels at anchor.

Aibika (Iviker) river mouth, about 4 miles north-west from Quilon, may be recognised by a remarkable break in the cocoa-nut trees; the entrance is very shallow, with rocks, and foul ground extending out to nearly 2 miles from the shore. A large vessel taking in cargo here, should anchor with the mouth of the river bearing E.N.E. in about 7 fathoms. The bar of the river has little more than 6 feet upon it at high water; within the entrance there is a great area of shallow water, and connection with the inland canal communication.

There is some export trade of timber, pepper, ginger, cardamoms, lac, and tumeric.

The coast from Aibika river to Cochin is sandy, and fringed with cocoa-nut trees.

Turcunapulli, lying 20 miles N.N.W. from the entrance of Aibika river, may be recognised by a flag-staff, temporarily erected in June 1894 to serve as a landmark, and for communication with vessels.

The Alleppi mudbank is reported to have shifted to this place, where vessels can anchor in 4½ fathoms.

PORAKAD (Porca).—The town of Porakad in lat. 9° 21′ N., long. 76° 25′ E., has but a small and diminishing trade.

Buoy.—A red buoy marking a mud bank and smooth water anchorage, lies in 4¼ fathoms, 2 miles off shore, with Alleppi lighthouse bearing N. ½ W., and Porakad large banian tree, E. ½ S. Vessels should anchor to the south-east of the buoy, in about 4 fathoms, soft mud.

ALLEPPI, the principal seaport of the rajah of Travancore, bears N. by W. ¾ W. 40 miles from Quilon (Tangacheri) point. The town is the second largest in the Travancore state, and lies between the sea shore and paddy-fields bordering the backwater, which forms an extensive lake. The coast between Quilon and Alleppi, except near Tangacheri, is sandy, and nearly straight; it can be approached with safety to the depth of 5 fathoms, mud, but towards Alleppi that depth is found nearly 3 miles off.

Alleppi is a slightly projecting part of the coast of Travancore, where trade is carried on all the year round, owing to the peculiar softness of its mud bank, which is so stirred up by the swell as to break the force of the

See chart, No. 750, and plan on it, of Alleppi road.

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waves, and cause a large extent of smooth water, on the outer part of which vessels anchor. This mud bank is of recent formation, the former bank having shifted a considerable distance south of the position it had in 1852, and by 1894 being situated off Turcunapulli, 17½ miles south of Alleppi.

LIGHT.*—From a white masonry tower, 115 feet high, which stands on the sandy beach about a cable inshore, a *revolving white* light, attaining its greatest brilliancy *every forty seconds*, is exhibited at an elevation of 113 feet above high water, and should be seen in clear weather from a distance of 17 miles.

Position.—Latitude 9° 30′ N., longitude 76° 19′ E.

Beacons.—Two boundary pillars, each 25 feet high, stand on the shore; the northern pillar is situated with the lighthouse bearing S.E. ¼ S. distant $2\frac{9}{10}$ cables; the southern pillar is situated S. by E. distant 1¼ miles from the northern pillar.

Population in 1891 amounted to 22,768.

Exports.—The export trade has an average annual value of £172,500, and consists chiefly of vegetable produce, coffee, cardamoms, ginger, pepper, cocoa-nuts, and coir.

Imports.—The annual import value amounts to £1,700.

Buoys.—A buoy, painted red, is moored in Alleppi roads, with the northern pillar bearing N.E. by E. ½ E., distant $1\frac{3}{10}$ miles; and another buoy, painted black, is moored with the southern pillar bearing E. by N. $1\frac{4}{10}$ miles.

Supplies.—Fresh water may be procured from a well at the beach. Fish of the best description is plentiful, and other supplies are abundant.

Anchorage.—In the fair season vessels of suitable draught may anchor off Alleppi in 3 or 4 fathoms, with the lighthouse bearing E. by N. and distant about 2 miles. During the south-west monsoon the best anchorage is further off shore in 4 fathoms, with the lighthouse N.E. by E.

Winds.—Severe gales are liable to occur on this coast in April, May, and June, also in October and November; a careful attention to the barometer will give sufficient warning of the approach of these storms to enable vessels to seek shelter at Narakal, or off Alleppi.

The south-west monsoon sets in at Alleppi generally in the beginning of June from the N.W., and blows with great violence, attended with thunder, lightning, and rain; the general direction of the wind during the south-west monsoon at this place is from W.N.W. to N.W.

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* Until 1st January 1899 this light will take *one minute* to complete each revolution.

See chart, No. 750, and plan on it, of Alleppi road.

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The COCHIN COAST, from Alleppi to Pallipur, is low and sandy, having no elevated land near the sea. The highest Ghats are nearly 50 miles inland, though several spurs, with remarkable hills, stand between them and the sea, but they are only distinguishable when the weather is clear. The Anamalai mountains, in the Coimbatore district and Travancore state, form a portion of the great Western Ghats, and eventually merge into the Travancore hills. The lower range of the Anamalai mountains is densely wooded with valuable timber.

Colungode bluff, the north-west extreme of these mountains (*see* page 7), about 40 miles E. ½ N. from Chaughat, forms the southern boundary of the Palghat gap, through which the land winds blow fiercely between November and February. This remarkable gap, more than 4,000 feet lower than the hills on its north and south, lies between the parallels of 10° 35′ and 10° 52′ N. In the fine weather of the north-east monsoon, Colungode bluff is very conspicuous, but after February is seldom seen.

COCHIN, standing on the south bank of the principal navigable entrance to the great Travancore estuary, along which it extends for a mile, has been a British possession since 1795, and contains several churches, custom house, post office, and other public buildings.

At the north side of the entrance is the town of Vaipin, inhabited by Konkanies and descendants of the Portuguese.

Inland Waters.—No rivers pass through the district of Cochin, which is limited eastwards by the grand estuary, formed by the interior rivers and backwaters. To the south-east, the principal arm of this estuary is extensive, and runs about parallel to the coast, its breadth varying from a quarter of a mile to 3 miles; it has a depth of one to 10 fathoms, and is affected by tidal influence. Discharging into the sea south of Cochin, these inland waters form a peculiar feature of the country; their banks are low and covered with luxurious groves of cocoa-nut, amidst which towns and houses, and at intervals the white fronts of churches, are seen. An arm of this estuary or backwater, south of Yeddacoclhi, extends into the interior, branching off to the west and south. The western branch forms into a broad but shallow lake, communicating by channels with other interior waters. One canal runs north and again forms water communication between Calvetti and Mattancheri.

LIGHT.—From a white column 91 feet high, situated on the south side of the entrance to the port of Cochin, is exhibited a *fixed white* light, elevated 100 feet above the sea, and visible in clear weather from a distance of 15 miles.

Position.—Lat. 9° 58′ N., long. 76° 14′ E.

See charts, Nos. 750 and 749; also plan of Cochin river, No. 65.

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Pilots.—Two Government pilots reside at Cochin, who, during the fine weather season, board and conduct vessels into the harbour, upon the pilot signal being made. Pilotage is compulsory for all vessels exceeding 100 tons burden.

Outer Anchorage.—The best anchorage outside the bar will be found with Cochin flagstaff (black and white bands) bearing from E. ½ N. to E.S.E., in 6 fathoms, soft muddy bottom, about 2 to 2½ miles off shore.

Trade.—The exports consist chiefly of timber, coir-yarn, fibre, rope, cocoa-nut oil, cocoa-nuts, coffee, pepper, nux vomica, fish oil, dried fish, and hides. The imports are rice, paddy, grain, sugar, metals, machinery, cotton-twist, and piece-goods.

The value of the **exports** for 1896–97 amounted to 13,375,404 rupees; of **imports** to 6,866,250 rupees.

In that year, 1,590 vessels of 422,108 aggregate tonnage visited the port, of which 1,387 of 60,551 tons, entered the inner harbour.

Population.—The population of British Cochin in 1891 amounted to 17,601.

Supplies.—Fresh provisions are plentiful, wood scarce. Water can be supplied alongside vessels in the harbour at the rate of 3 rupees per tun. (From Alwaye, 18 miles distant.) The water obtained locally is brackish and unwholesome.

There is no dock, but wooden vessels of small tonnage can be hove down. Small repairs to hull and machinery can be made by an European workshop.

Coal cannot be procured at Cochin.

Quarantine regulations.—During the prevalence of plague in Northern India, vessels obtain pratique before communicating with the shore. At other times there are no special regulations.

Hospital.—Sailors are admitted into the Civil Hospital.

Communication is by regular coasting and semi-coasting service. Telegrams can be despatched to all parts.

Boundary.—A boundary pillar, white, 13 feet high, stands on the river bank, 4 yards from high water mark, and 75 yards from the Sea Custom House, to show where Cochin Sirkar territory adjoins British Cochin.

LIMITS OF THE PORT.—To the North.—The boundary pillar, on the northern point of the entrance to the harbour or backwater.

See plan of Cochin river, No. 65.

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To the South.—The boundary pillar, 3 miles south of the southern point of the entrance; and the sea-shore between these limits, to within 50 yards of high water mark, spring tides.

To the East.—The harbour and backwater, with all creeks and channels leading thereto, that may be within the British territories, and so much of the shores thereof, whether of the mainland or the islands, as are within 50 yards of high water mark, spring tides.

To the West.—The space enclosed by two lines extending due west from the boundary pillars to 9 fathoms water.

Storm Signal.—Storm-warning signals are made at Cochin; for particulars *see* page 56.

Buoys.—The fairway channel over the bar is marked by two buoys surmounted by baskets, the southern buoy is painted red, the northern buoy is coloured black. About halfway between the northern buoy and Vaipin point, on the north side of the channel, is moored an iron conical buoy, painted black, to mark the southern side of a sand spit.

A green wreck buoy marks the spot where a lighter lies sunk in $5\frac{1}{2}$ fathoms, with the lighthouse bearing S. 83° E.

The bar buoys are removed from 15th May to 15th September, the port being considered unsafe and closed to sailing vessels between those dates. The inner buoy always remains in position.

Navigable Depths.—The Bar.—The deepest water on the bar in the year 1889 was 13 feet at low-water, 16 feet at high-water springs, and 14 feet 6 inches at high-water neaps; the channel, as buoyed, is about 3 cables in width, north and south. No vessel has entered the port of more than 13 feet draught. The bar is a narrow hard sand ridge.

Directions.—To cross the bar in the deepest water, bring the inner black buoy open to the south of Vaipin or Builder's point, E. by N., steer towards the inner buoy, passing about half a cable south of it, then steer E. $\frac{3}{4}$ N. midway between the Cochin and Vaipin shores, and anchor when the whole of Gondu island is open clear to the eastward of Vaipin, in from 6 to 8 fathoms.

The High School of Ernakolam (a large red building) on the eastern shore of the backwater, touching the north end of the wharves of Cochin E. $\frac{1}{2}$ N., leads close southwards of the north bar buoy, and half a cable south of the inner buoy.

Caution.—The bar is dangerous for ship's boats when the ebb tide runs out strong against the sea-breeze; it then causes a short chopping sea

See plan of Cochin river, No. 65.

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All signals to vessels in the outer roads are made from the lighthouse column, and sailing vessels are sometimes directed to proceed to Narakal for safety.

Tides.—It is high water, full and change, at Cochin at 11 h. 26 m., springs rise 3 feet, neaps 1½ feet. The night tides are about 6 inches higher than the day tides during the fine season, or from November until March; the contrary is the case from May to August. In April and September night and day tides are about equal. The highest tide takes place on the third day after full and change of the moon.

The tide on the bar is about 30 minutes earlier than at Vaipin, and 1 h. 15 m. earlier than at the Residency in the backwater.

The stream of the ebb at springs during the north-east monsoon is 2 to 3 knots, and of flood one to 2 knots. The flood stream sometimes runs in, or from the westward for two hours before the level of the water commences to rise. During the south-west monsoon, lasting from May to September, the flood runs 4 knots, and the ebb 5 knots; freshets may then be expected.

During the rains the tide runs out, or to the westward, at times without interruption for 4 or 5 days; the flood at that season being uncertain.

NARAKAL situated about 5 miles N. by W. from the town of Cochin belongs to the native state of that name. Its position may be known by a high flagstaff (painted black and white chequered); a former conspicuous opening in the belt of cocoa-nut trees which fringe the coast, is filling up with growing trees. Cochin lighthouse is also a good guide.

An obelisk, 25 feet high, and painted white, with one black band in centre, has been erected on the beach in lat. 10° 2′ N., long. 76° 13′ E. (approximate), and three-quarters of a mile south of Narakal flagstaff.*

A short distance southward of Narakal there is a mud flat which breaks the force of the ocean swell, and the sea usually existing in an open roadstead is here barely felt in a depth of 5 fathoms; under 3 fathoms the water is smooth. In consequence of the absence of surf on the beach abreast, communication with the shore can be maintained throughout the year, and in all weathers by ordinary boats.

Cochin can be reached in two hours by land or backwater.

Supplies.—Provisions and water may be obtained, and the repair or refitment of vessels can be effected.

LIGHT.—A *fixed white* light is shown at a height of 95 feet above high water, on the flagstaff at Narakal during the south-west monsoon; namely, from 15th May to 30th September, which should be visible in clear weather from a distance of 10 miles.

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* The above position holds good as long as the mud bank exists in this locality. *See* chart, No. 749.

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Anchorage.—An anchoring buoy, painted red, is moored in 3 fathoms water with Narakal flagstaff bearing E. by N. ½ N. and Cochin lighthouse S.E. by S. Owing to the mud flat south of Narakal having shifted considerably to the southward, the best anchorage is in from 4 to 5 fathoms water, about 2½ miles from the shore, with Narakal obelisk bearing N. 45° E., flagstaff bearing N.N.E. ½ E., Mallipurum flagstaff at 2 miles south of Narakal, N. 67° E., and Cochin lighthouse S. 50° E.

Mallipurum is (1895) used for landing and shipping operations; the flagstaff (black and white chequered) shows above the tops of the cocoa-nut trees, and signals from vessels in the roads are attended to.*

At the first burst of the south-west monsoon there is always a sea prevailing in the road and on the shore, but after the lapse of about a week the water becomes smooth, though the surrounding sea is much disturbed.

PALLIPUR RIVER.—Kranganur, is situated on the north side of, and 2½ miles within, the mouth of the river, the entrance to which lies 14 miles northward of Cochin, and is generally conspicuous from the westward by the gap in the foliage.

The river has a bar, and is only available for small coasting craft. The times of high water, and the rise of tide, are almost the same as at Cochin, but more regular; the rise and fall is a little greater.

Attupuram, nearly 6 miles northward of the entrance to Pallipur river, is marked by a boundary pillar standing near the beach, which is 20 feet high, and painted with black and white vertical stripes.

MALABAR COAST.—The south extreme of the British province of Malabar is in lat. 10° 15′ N., and its northern limit in lat. 12° 18′ N., but mariners frequently call the whole extent of seaboard from cape Comorin to Bombay by this name.

The southern portion of this coast, from Pallipur to Beipur, is low, sandy, fringed with cocoa-nut trees, and devoid of conspicuous landmarks; thence to mount Dilli, the coast is composed of sandy bays, with occasional slightly elevated rocky points. There are some hills at the back of Beipur. Mount Dilli is a remarkable headland 850 feet above the sea, with low sandy ground inland, which is less than 100 feet in elevation at a distance of 2 miles from the mount, and rises gently towards the Ghats, attaining the same elevation as mount Dilli at about 12 miles from it.

The Kunda range approaches the sea between Calicut and Tellicherri, and is higher here than on any other part of the west coast. The highest and most remarkable, named the Camel's Hump (*see* page 136), is

* A small can buoy, painted green, is placed in $\frac{1}{8}$12 feet water, half a mile from the shore, with Mallipurum flagstaff bearing N. 19° E., to mark the site of the wreck *Adolf*. *See* chart, No. 745.

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north-eastward, more than 20 miles from Calicut. The Wynad range, at the back of Tellicherri, has several conspicuous peaks, the most western standing prominently forward only 10 miles eastward of that sea-port; northward of them the high land recedes more from the coast, and the valley of Beliapatam river occupies the space to the mountains of Coorg (Kurg) which are far from the sea, and can only be seen in very clear weather.

CHAUGHAT, lies near the entrance of the river of that name, at 22 miles north of Pallipur. On the sandy spit north of the river entrance, 50 yards from high water mark, stands a boundary pillar, 20 feet high, painted with two black and white horizontal bands. Vessels anchor in 6 fathoms mud off the river entrance; small coasting vessels only can enter the river at high water.

The sea-face of this part of the coast is low, sandy, and fringed with cocoa-nut trees, amongst which houses are visible at intervals. Three miles southward of the entrance to Chaughat river there is, near the sea-beach, a boundary pillar, 20 feet high, painted white. At a distance of 15 miles east from Chaughat is the base of the mountains; but off that place it is difficult to make out any particular peak. There is a small round red hill about 250 feet high, with a tree on its summit, about 8 miles north-east of Chaughat. About 18 miles E.N.E. from Chaughat there is a range of hills between the Ghats and the coast; its highest part, more than 1,000 feet above the sea, terminates abruptly towards the south.

PONANI RIVER entrance, situated 18 miles northward of Chaughat, has a bar with not more than 7 feet at low water ordinary springs, and is only available for small coasting craft. The depôt of teak timber, from the Anamalai forests, is at the town of Ponani on the south side of, and half a mile within, the entrance. There is a large trade between Ponani and Cochin by backwater.

A vessel may anchor in 5 fathoms, mud, with the south entrance point bearing E.N.E., rather less than one mile westward of the bar.

Beacons.—A boundary pillar, white, 20 feet high, stands one mile north of the river entrance, upon the sand ridge, 75 yards from high water mark. A similar pillar stands one mile south of the river entrance on the sea-beach, 75 yards from high water mark.

Approaching from the southward, the tree point on the south side of the river is conspicuous, and the extensive backwater forms a large gap in the line of trees when bearing about E.N.E. About 9 miles north-east from Ponani is table-land about 300 feet high, with a few scattered trees on its summit. The hill named Dolphin's head lies 18½ miles N. by E. ¾ E.,

See chart, No. 749.

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and the Sisipara range about 6,000 feet high, 36 miles N.E. by E., from Ponani.

Tanur, formerly a prosperous seaport, is situated at the mouth of a small river midway between Ponani and Beipur. There is some table-land about one mile north-east of the town, with a tuft of trees upon it.

BEIPUR RIVER rises in the hills south of Neddivattam pass, and after draining the Ochterlony valley, descends by a series of cataracts over the Ghats north of the Kurkur pass. It debouches into the sea in lat 11° 9′ N., long. 75° 48′ E., being joined near the mouth by the Kudelimdi, with which it forms the island of Chaliyam on the south side of the entrance. Beipur river has a bar, the passage over which commences 2 cables westward of Rocky islet 30 feet high, on the south side of entrance; the islet is connected with Chaliyam by a sea-wall. A reef with rocks above and below water extends half a mile in a southerly direction from Rocky islet; the southernmost and largest of these, named Black rocks, are 4 feet high. About 1¼ miles S. ½ E. from Rocky islet, and nearly one mile from the shore, there are two rocky shoals with depths of 6 and 8 feet upon them, and 2½ fathoms close around.

Navigable depths.—On the bar there is a depth of 4 feet at low water, and 9 feet at high water springs; and of 6 feet at low water, and 8 feet at high water neaps. The bar is but half a cable across, when the depth increases suddenly to 8 feet, and soon after to 13 and 17 feet, low water springs. From the entrance to the railway bridge, a distance of 2 miles, the least depth in the channel is 5 feet at low water springs, and on the south side of the bridge there is a pool with 3¾ fathoms.

Anchorage.—Steam vessels of moderate draught usually anchor in 22 feet, with the flagstaff bearing E. by N. ½ N. and the woody hill 3 miles south of Beipur, S.E. by E. ½ E. Large vessels anchor further off shore.

Caution.—Vessels should not approach this part of the coast at night to a less depth than 8 fathoms.

Tides.—It is high water, full and change, at Beipur at 11 h. 16 m.; springs rise 5 feet, neaps rise 4 feet; neaps range 2 feet. There is a diurnal inequality in the heights of high and low water, maximum 2½ feet in each case. The day tides, as a general rule, rise higher than the night; they also fall lower than the night tides. This refers only to the fine season, October to May.

Beipur.—The town of Beipur, situated on the north side of the entrance, became of importance in 1850, when it was made the terminus of the Madras railway, which crosses the river about 2 miles above the town.

See chart, No. 64, and plan on it, of entrance to Beipur river.

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Population in 1881 amounted to 5,339.

Shipping.—In 1896-97, there entered the port 763 vessels, with an aggregate tonnage of 53,171.

Exports.—The chief exports consist of coffee, ginger, copra, cocoa-nuts, timber, coir rope, cotton, salt fish, betel-nuts, jaggery, and tumeric, valued in 1896–97 at 3,243,439 rupees.

Imports consist of pearl, twist and yarn, cotton piece goods, paddy, rice, gunny bags, metal, sugar, tobacco, and woollen piece goods valued at 407,420 rupees.

There is good landing at low water during north-west winds, on the east side of the rocks extending southward from Rocky islet, when the bar of the river is unsafe to cross. Boats should pass round the south end of these rocks where they are steep-to.

Chaliyam is low and woody, but at the back the land rises gradually. Kolahcoon, or One-tree hill, bearing E.S.E., and distant about 3 miles from the river mouth, is about 200 feet above the sea.

The Dolphin's head, a wooded hill about 900 feet above the sea, bearing E. by S. ½ S., distant 13 miles from Beipur, shows well when seen over Calicut, or bearing about S.E.

CALICUT, situated 6 miles north of Beipur, was the first port in India visited by Europeans, the Portuguese having landed here about 1486. The town contains the chief establishments of the Malabar district, and has hospitals, custom house, and post office.

Communication.—Calicut is now the terminus of the Madras railway, and is in connection with the telegraphic system of India. The British India Company's steam vessels call weekly during the fine season.

Population amounted to 66,078 in 1891.

Trade.—Shipping.—The chief exports consist of coffee, ginger, cocoa-nuts, oil cake, cardamoms, pepper, timber, coir, and cotton, which in 1896–97, amounted to Rs. 9,441,140. The imports are pearl, cotton piece goods, rice, metal, seeds, sugar, tobacco, and woollen piece goods, amounting to Rs. 5,989,977.

The number of vessels that entered the port of Calicut in the same year was 2,094 of 403,082 aggregate tons.

LIGHTS.—From a white column 98 feet high, situated on the beach close to the town, a *fixed white* light is exhibited at an elevation of 103 feet above high water, visible in clear weather from a distance of 16 miles, when bearing from S. 14° E. (through East) to N. 25° W.

A small *red* light is shown from the T-head of pier.

See chart, No. 64, and plan on it, of entrance to Beipur river.

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Pier.—There is a screw-pile pier 174 yards in length, near the custom-house, at the northern end of the town.

When the sea-breeze is strong, it is found more convenient to load from the beach abreast Conolly's hill, about 2 miles north of the pier, where the surf is more moderate than near the town. The water is also smoother by the entrance of Kallayi river, 1½ miles south of the lighthouse, the shore being partially protected by Coote reef. Large kotias and pattimars are built on this part of the beach.

Anchorage.—Conolly's hill, about 200 feet high, with the residences upon it showing amongst the trees, is a useful landmark when approaching Calicut. Steam vessels usually anchor in 4¼ fathoms, mud, with the highest tree on this hill bearing N.E., and the lighthouse E. by S.; sailing vessels farther out in 5 fathoms. Vessels should not anchor to the southward, the bottom being foul and rocky.

Buoy.—A pillar buoy, painted black, is moored 1 $\frac{9}{10}$ miles N. 89° W. from the lighthouse, in 4 fathoms at low water, to mark the southern and eastern limits of the anchorage off Calicut. This buoy is liable to be washed away.

Landing signals.—A red and white chequered flag, hoisted at the flagstaff, indicates that landing is dangerous. A red and white chequered flag, above a pendant, indicates that landing is impracticable.

The signal for a boat at night is three lights, placed horizontally, near each other.

Gillham rock, on which the sea breaks occasionally, has a depth of 3 feet on its shoalest part, and is the southernmost danger in the vicinity of Calicut; it lies S. ¼ W. 2 miles from the lighthouse, with its outer edge 7 cables from the shore.

Coote reef (named after the late E.I.C. sloop of war *Coote*, which was lost on it), with 3 feet least water, on which the sea generally breaks, lies with its outer edge 1 $\frac{1}{10}$ miles S.S.W. ¾ W. from Calicut lighthouse, and three-quarters of a mile from the shore.

To the south and east of the reef the bottom is soft mud; and small coasting craft anchor in 10 to 12 feet at low water, partially protected from north-west winds by the reef. In the anchorage for these vessels north of the reef there is a small rocky patch with 8 feet water upon it, from which Calicut lighthouse bears E. ¼ S., 5 to 6 cables.

Buoy.—A red can buoy is moored in 2½ fathoms water 2½ cables south-west of the shoalest part of Coote reef, at 1⅓ miles S.S.W. ¼ W., from the lighthouse.

See chart, No. 64, Sacrifice rock to Beipur.

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Calicut reefs consist of a cluster of dangerous rocky shoals, with 2¼ to 3¾ fathoms water. From the shoalest part of the northern reef, Calicut lighthouse bears N.E. by E. ¼ E., 1½ miles, thence the reefs extend 1½ miles in a southerly direction to abreast Gillham rock.

Anchorage reef, with 2¼ to 2¾ fathoms upon it, lies with its north-west edge, West, 1½ miles from Calicut lighthouse, and about 4 cables inside the anchorage buoy.

Reliance shoal, a patch of rocky ground with 4¾ to 6½ fathoms upon it, half a mile wide, and 2½ miles in length, lying parallel to the shore, has its south extreme bearing W. by N., distant 3½ miles from Calicut lighthouse. The bottom around consists of soft mud.

Tides.—It is high water, full and change, at Calicut, at 10 h. 59 m.; springs rise 5 feet, neaps 4 feet. There is a diurnal inequality in the heights of high and low water, maximum 2½ feet in each case. For high water the day tides are as a general rule higher than the night. For low water the day tides fall lower than the night. This refers only to the fine season, October to May.

ASPECT OF COAST.—From Ponani to Kadalur point the coast is low, sandy, and fringed with cocoa-nut trees, with red laterite hills at the back. About 10 miles inland of Calicut are isolated hills about 800 feet high. The best distinguishing mark for Calicut in the morning is Conolly's hill with its houses showing amongst the trees; in the afternoon the white column of the lighthouse shows well when 10 miles off.

Mountains.—The Camel's Hump, about 7,000 feet above the sea-level, bears from Calicut lighthouse N.E. by E. ½ E. 22½ miles; it may be seen in clear weather as soon as a vessel is on the bank of soundings; but in the hazy weather of March and April it is frequently indistinct from the anchorage off Calicut. The south extremity of the Kunda range is rather abrupt, the mountains thence receding far to eastward.

At 12 miles north-west of Camel's Hump and 20 miles E. by N. from Kadalur point lies the mountain named Tanote Mullay, between 4,000 and 5,000 feet above the sea. The Dolphin's Head bearing S.E. by E. from Calicut, distant 17 miles, shows well to a vessel coming from the north.

Varakal is a small village situated about 3 miles north of Calicut, having abreast it a bank of very soft mud, in consequence of which the water is generally smoother on the beach here than at Calicut. This bank has been known on rare occasions to shift down the coast as far as Calicut, but it generally remains abreast Varakal.

See chart, No. 64, Sacrifice rock to Beipur.

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Elatur cape.—About half a mile north of Varakal and 2 cables from the shore lies Rocky islet, 8 feet high. Between this islet and Elatur cape, 1¼ miles north of it, the coast recedes slightly and forms a small bay, named Padiangadi. Elatur cape is low and rocky, with sand-hills and cocoa-nut trees at the back. About a mile north of the cape lies the mouth of Elatur river, shallow, rocky, and navigable for small boats only. There is good landing at 3 miles north of Elatur river, on the south side of a large black rock with a tree on top.

Quilandi is a considerable town in the bay, 6 miles north of Elatur river. The bottom being here soft mud, the shore is free from surf, and landing may be easily effected in ship's boats. East and north of Quilandi the land is hilly and undulating. At 2 miles south of Quilandi and about one-third of a mile from the shore, there is a small rocky shoal nearly awash with 7 to 10 feet close around.

KADALUR (Cotta) POINT.—Between Quilandi and Kadalur point, at 3½ miles north-west of it, the shore recedes and forms a shallow bay. Kadalur point is low, but prominent, and covered with cocoa-nut trees, over which will be seen a large round tree; from this point hills rise gradually in a north-east direction.

Kadalur reef, on several parts of which there is less than 6 feet water, extends nearly 1½ miles to the southward, and for one mile in a westerly direction from the point.

Tikkodi point, a low rocky point, off which rocks dry at low water extend some distance, lies 1¼ miles north-west of Kadalur point. Tikkodi reef extends one mile south-westward from the point; its west extreme, bearing W. by N. 1⅔ miles from Kadalur point, has depths of 8 feet upon it.

SACRIFICE ROCK, 58 feet above the sea, bears from Calicut lighthouse north-west 20½ miles, and from Kadalur point W. by N. ½ N. 6 miles. It is composed of granite, and having a white appearance from birds' deposit, may be seen from a distance of 10 miles in clear weather. It lies just within the 10-fathoms contour-line of soundings, and at 2 miles seaward there is a depth of 15 fathoms. The channel between the rock and the mainland is clear, but a vessel using it should borrow towards the rock, and not shoal under 7 fathoms towards Tikkodi reef. Vessels passing outside Sacrifice rock in the night should keep in not less than 16 or 17 fathoms water.

To the north-east, 5½ miles from Sacrifice rock, is the mouth of a small river which leads by backwater nearly to the town of Badagara, about 2 miles north of the entrance. A remarkable round red hill, about 250 feet high, called Nimanar, stands on the south bank of this river, about one mile from the entrance.

See chart, No. 64.

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BADAGARA, in lat. 11° 36′ N., long. 75° 34′ E., is an important town situated on the coast, at the northern extremity of the Calicut backwater, and on the trunk road from Calicut to Kannanur. Badagara is the headquarters of the taluk officials, with custom house, post office, &c. At the back of the town, and continuing on to Kannanur, are pretty undulating hills about 400 feet high; these and the Wynad range of mountains to the eastward, with their remarkable and lofty peaks, make this the most beautiful part of the Malabar coast.

Anchorage may be obtained in 5 fathoms, mud, abreast the town of Badagara, about 2 miles from the shore.

MAHE, situated 7 miles north of Badagara, is a small French settlement on the south side of Mahe river entrance. The French territory extends along the beach in a southerly direction little over half a mile, and in a northerly direction to the middle of the river. The custom house for the British port of Kallai stands on the north bank of the river, about a quarter of a mile above Mahe bridge. At a short distance west of the custom house, there is a roadway leading from the river to a small detached part of the French territory known as Nalutara; a right of way has been conceded to the French along this road. The coast road from Beipur to Tellicherri and to the military station at Kannanur, passes through Mahe. The land at the back of Mahe consists of detached hills, on which are old forts and houses. The French population numbers (1889) between 8,000 and 9,000.

Rocks extend out from both sides of the river entrance, as far as the 2-fathoms line of soundings. During the dry season the channel leading into the river lies near the south bank, and does not exceed 20 yards in width. The rocks on the south side, not above water, are marked by flags. In the year 1886 there was a depth of 5 feet on the bar. The channel is buoyed during the north-east monsoon, and all buoys should be passed close-to, on the starboard side entering. The bar is considered dangerous except in very smooth water.

Trade.—The chief imports at Mahe are wine, spirits, rice, and coal; the exports consist of salted fish and the product of the cocoa-nut palm. At Kallai the chief imports are rice and paddy; the exports timber and the produce of the cocoa-nut palm.

LIGHT.—On the south side of Mahe river entrance a *fixed red* light is exhibited from a mast 50 feet high, at an elevation of 88 feet above high water, and should be visible in clear weather at a distance of 3 miles. Shown only during north-east monsoon.

See chart, No. 747.

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Anchorage.—Vessels may anchor off Mahe in 5 fathoms, mud, 2¼ miles from the shore, with the flagstaff bearing E.N.E.

TELLICHERRI is situated nearly 4 miles north-west from Mahe. The fort (built 1708, and still in excellent preservation,) stands on rising ground near the sea, about 35 feet above its level; the main part of the town lies at the back, and to the southward of the fort. The Roman Catholic chapel on the point immediately under the fort is conspicuous; the Port office flagstaff stands on the beach, one-third of a mile southward of the chapel. The hills in the immediate vicinity of the town are thickly covered with cocoa-nut, and other trees.

Tellicherri is the headquarters of the North Malabar district; has a district court and the usual establishments. There is also a Protestant church.

Population.—The inhabitants within the municipal area numbered 27,196 in 1891, composed approximately of 16,000 Hindus, 9,400 Mohammedans, and 1,800 Christians.

Communication.—Good roads connect Tellicherri with Calicut, Kannanur, Wynad, Mysore, and Coorg. There is a daily mail service to Madras and other parts *vid* Calicut, and a telegraph office in connection with all parts of the world by the system of India. Railway extension from Calicut to Tellicherri and Kannanur is in progress.

Steam vessels call regularly, and during the season vessels sail direct for Europe with coffee and pepper.

Exports, which consist chiefly of coffee, pepper, cardamoms, sandalwood, salted fish, and manure (the last two articles to Colombo), were valued in 1896–97 at 7,323,236 rupees.

Imports, consisting chiefly of rice, piece-goods, twist, and yarn, metals, and liquor, were valued at 3,617,134 rupees. Small native craft bring much coir-yarn to this place and to Kannanur from the Laccadive islands, taking away rice in exchange.

Shipping.—In the same year Tellicherri was entered by 990 vessels, with 291,103 aggregate tonnage.

Supplies.—Good water and fresh provisions of all kinds may be obtained at Tellicherri.

Limits of the port.—The northern limit of the port extends from a boundary pillar at the extreme of Kodali point, in a westerly direction to a depth of 9 fathoms; and the southern from a pillar 6 cables eastward of Nilot point, westerly to 9 fathoms.

See plan of Tellicherri anchorage, No. 1,322.

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Ballast Ground.—Ballast must not be thrown overboard in less than 10 fathoms water under a penalty of 200 rupees.

Storm Signal.—Storm-warning signals are made from the custom-house flagstaff; for particulars *see* page 56.

LIGHT.—From a small masonry tower, 27 feet in height, at the north-west angle of the fort, a *fixed white* light is shown at an elevation of 88 feet above high water, visible seaward from S. 59° E. to N. 28° W., in clear weather from a distance of 8 miles. Partially obscured by trees from N. 11° W. to N. 28° W.

At half a mile south-west of the fort, parallel with the coast, is a ridge of basalt rock, 2½ cables long and 20 feet high, called Bilikulu; between which and the shore are numerous detached rocks, above and below water, which afford shelter to the landing place at low tide during north-west winds.

Green and Darmapatam islands.—Green island, 66 feet high, situated 2½ miles N.W. by W. ½ W. from Tellicherri lighthouse, and 1½ cables from Darmapatam island, is covered with cocoa-nut trees and surrounded by rocks; between this island and Tellicherri rocks there are numerous detached reefs and rocks above and below water.

Darmapatam island is formed by the Anjerkandi river, which, after a course of about 40 miles from the Wynad Ghats, divides into two branches. This river was the great highway for pepper before the days of good roads, and as Darmapatam commanded the entrance it was fortified; the remains of a redoubt on a bare hill about 200 feet high are conspicuous. The southern entrance of the Anjerkandi river is used by the cargo boatmen for laying up during bad weather or for repairs. The northern entrance to the Anjerkandi river is blocked up by a sand bar on which the sea always breaks. Both channels are only navigable for country small boats.

The Kodali river is an insignificant stream extending a few miles behind Tellicherri, which enters the sea near the south arm of the Anjerkandi.

Anchorage.—Large vessels should anchor well out in 6 or 7 fathoms when there is a probability of unsettled weather; but in the fine season vessels may anchor in 5 fathoms, soft mud, with the lighthouse bearing N.E. ¾ N., and Green island N.N.W., nearly 1½ miles from the rocks.

Tides.—It is high water, full and change, at Tellicherri, at 11 h. 3 m.; springs rise 4½ feet, neaps rise 3¼ feet.

KANNANUR bears from Tellicherri N.W. ¼ W. 9½ miles. The fort stands on a low rocky point, northward of which are barracks for European troops, and houses extending along the cliffs for some distance.

See plan of Tellicherri anchorage, No. 1,322.

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On the beach, in a shallow bay eastward of the fort, stands the Native or Old town, and the Port office.

A small detachment of European, and a regiment of Native troops form the garrison.

Landing can be effected in ships' boats in the bay north-east of the fort (where there is a small pier), in fine weather; but with southerly winds a heavy swell renders it impracticable.

Supplies.—Good water may be obtained from wells on the beach north-east of the fort; fresh provisions and excellent fruit may be procured.

Population of Kannanur in 1891 was 27,418.

Communication.—The British India and Asiatic Steam Navigation Company's steamers call regularly. There is a daily mail to Madras, &c., and connection with the telegraph system of India.

Trade.—Shipping.—In 1896–97 the exports were valued at Rs. 1,340,426, and the imports at Rs. 1,782,870. Kannanur was in that year visited by 1,125 vessels of 214,478 aggregate tonnage.

LIGHT.—A *fixed red* light, elevated 64 feet above the sea, is shown from a small, light yellow tower, 25 feet high, on the rampart of the fort, near the flagstaff, at Kannanur. The light is visible seaward in clear weather from a distance of 6 to 8 miles, between the bearings of N. 59° W. and S. 70° E.

Anchorage.—Convenient anchorage will be found in 5 fathoms, mud, good holding ground, S.W. ½ S. from the lighthouse, with the boundary pillars bearing respectively north and E. by N. The 5-fathoms contour-line passes about 1½ miles from the fort point, off which rocky ground extends 7 cables.

Limits of the Port.—The limits of the port of Kannanur are two imaginary straight lines running due west from two boundary pillars to 9 fathoms. The boundary pillars are conspicuously placed on the rocky points about one mile north and 1½ miles south of the fort.

Tides.—It is high water, full and change, at Kannanur, at 10 h. 51 m.; springs rise 4½ feet; neaps rise 3¼ feet; neaps range 2 feet.

Beliapatam River and Town.—Beliapatam river, situated about 7 miles north of Kannanur, rises from several sources in the Ghats on the borders of Coorg, and joins, at the foot of the hills, another large stream flowing from the range in the north-east of Monatuna. Immediately below the junction the united stream is spanned by the Irriti bridge, on the high road from the coast to Coorg and Mysore. From Irrikur, where it becomes navigable all the year round for large boats, it flows

See plan of Kannanur anchorage, No. 1,322; also chart, No. 747.

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westward to Grovapoya, where another stream, rising from the same sources, joins it, the river widening considerably at the confluence.

The town, with a population (1871) of 7,579, is situated on the left bank of the river about 4 miles from its mouth, and the same distance from the cantonment of Kannanur. It possesses a thriving trade, steam vessels occasionally calling at the river mouth.

MOUNT DILLI, in lat. 12° 2′ N., long 75° 12′ E., is a conspicuous headland, 850 feet high, and may be seen from a distance of 25 miles in clear weather, but in the hazy weather of March and April scarcely 15 miles. The south-west extreme of this headland is a bluff point joined by a low neck to the mount, and having on it an old fort which is 160 feet above the sea.

Mount Dilli is an island, though separated from the main low land by a very narrow creek; on its eastern side there is a bay in which small coasters find convenient shelter, in 3 or 4 fathoms, against north-west winds, which greatly prevail off this cape from February until May, producing a drain of current to southward, and a short confused swell.

The shore here is bold, and a vessel working up the coast may approach into 6 fathoms water.

See chart, No. 747.

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CHAPTER IV.

KANARA AND GOA COASTS.—MOUNT DILLI TO TIRACOL RIVER.

(Lat. 12° 2′ N. to lat. 15° 43′ N.)

VARIATION, 0° 40′ East in 1900.

KANARA.—The province of Kanara is divided into two districts, North and South Kanara, the former of which is in the Bombay presidency, the latter in that of Madras.

SOUTH KANARA.—The coast of South Kanara, extending from lat. 12° 5′ to lat. 13° 53′ N., is low, sandy, fronted with numerous groves of cocoa-nut palms, and intersected with several rivers, all of which take their rise in the western Ghats. Many of these rivers are navigable during the fair season for 15 to 25 miles, and have a considerable boat traffic. The most densely inhabited tract, situated along the seaboard of this district, and extending into the interior from 5 to 25 miles, may be described generally as a broken table-land of laterite, varying in height from 200 to 400 feet, rising to 600 feet towards the Ghats.

At about 18 miles north of mount Dilli, one mile from the shore, stands the old fort of Hosdrug on ground about 150 feet above the sea; and a short distance behind it a wooded hill, 580 feet high, the outermost detached hill of a spur which stretches westward from the mountains of Coorg. On this spur there are some conspicuous peaks, increasing in elevation as they near the Ghats, which in Coorg are 4,000 to 6,000 feet high; these higher and more distant peaks are seldom visible from the sea except in very clear weather.

Kavai river, which runs close around the north side of mount Dilli, is the boundary between the provinces of Malabar and Kanara. The entrance to this river lies about 4 miles north of Yeli redoubt (on the south-west point of mount Dilli), thence it runs in a northerly direction for 15 miles, but is only available for small boats.

BEKAL FORT, on a small prominent point, 130 feet high, lies 24 miles north of mount Dilli; there is a traveller's bungalow among trees north of the fort. Rather more than 1½ miles north-west from this fort, and half a mile south-west from a small rocky cape, there is a reef of rocks on which the sea breaks, having 4 fathoms close to it.

See charts, Nos. 746 and 2,737.

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Kassergod river entrance lies between the two hill forts of Kassergod and Chendragiri, 5½ miles north of Bekal; it is only available for very small coasters at high water. The bar of this river is subject to frequent change. There are a few rocks along the shore about 2 miles southward of the river mouth.

Cumla river, situated 7 miles north of Kassergod, has a depth in its entrance of about 7 feet at high-water springs, and generally there are breakers across the entrance which often changes.

BARN HILL.—At 7 miles N.E. ½ N. from the mouth of Cumla river stands Barn hill (Pussodi Gumpa), a sloping mount, nearly level on the summit, and 1,000 feet above the sea. This hill, with Mudapin-guda, 700 feet high, lying 8 miles N.N.W. ½ W. from it, are useful landmarks for this part of the coast.

Munjeshwur is a creek 8 miles northward of Cumla, from which Barn hill bears E. by S., and is distant 8 miles.

MANGALORE, the chief town of the South Kanara district, is situated on the backwater formed by the convergent mouths of the Bantwal and Gurpur rivers, and contains custom house, several churches, and a post and telegraph station.

Mangalore clears and exports the coffee of Coorg, and trades direct with Arabia and the Persian gulf.

Population.—The number of inhabitants in 1891 was 40,922.

LIGHT.—From a small white tower, 65 feet high, on the hill at the back of the town, is exhibited, at an elevation of 240 feet above high water, a *fixed white* light, visible in clear weather from a distance of 14 miles.

A new light to be established at Mangalore will be exhibited from a white masonry tower on the southern part of the Marine yard. It will be a *fixed white* light, elevated 33 feet above high water, and visible in clear weather seaward, from a distance of 11 miles. Approximate position, lat. 12° 50¾′ N., long. 74° 49½′ E.

On the exhibition of a light (probably in June 1899,) to be established at Cahp, the light (fixed white) *now* (1898) shown at the back of Mangalore will be discontinued, though the tower will remain.

Landmarks.—The vicinity of Mangalore may be recognised by Barn hill, 16 miles to the south-east, and the Asses ears, a rugged double-peaked hill, 1,100 feet high, 17 miles to the north-east; the latter rises almost vertically from the low country, but in some views is nearly obscured by intervening flat hills.

On nearing the place, the old lighthouse tower, with the houses and trees near it, and a tall factory chimney will be seen.

See chart, No. 746, and plan on it, of Mangalore.

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The hills at the back of Mangalore are undulating, and separated from each other by valleys, through which rivers run from the mountains.

Mount Haidar (horse's face), 6,100 feet high, situated 30 miles N.E. by E. from Mangalore, and falling abruptly towards the south, is the south-west extreme of the Nagar district of Mysore, beyond which the Ghats recede to the eastward.

Navigable depths.—The bar has 9 feet water on it at low-water springs.

Tides.—It is high water, full and change, at Mangalore, at 11 h. 0 m.; ordinary springs rise 7 feet, neaps 5 feet; night tides are higher than day tides in the fine season.

Anchorage.—In consequence of the mouth of the river shifting, the best anchorage (September 1886) is in not less than 4 fathoms at low water, with the lighthouse building at Marine yard bearing N.E. by E. ½ E., and the old light tower from N.E. to N.E. by N. This anchorage is subject to constant alteration.

The Gurpur mouth of Mangalore harbour is closed for traffic for sea-going vessels, owing to the bad state and intricacy of the channel leading into it.

Small native vessels may enter the Ullal or southern mouth at high water, and will find good anchorage inside the sand spit; but as the bar is very shallow, no large native vessels can enter the harbour laden, or find shelter from the north-westerly winds which prevail in March, April, and May. All vessels should be provided with good ground tackle for anchoring in the outer roadstead.

Directions.—In approaching Mangalore from the northward, caution is necessary at night or in thick weather to avoid St. Mary isles and Mulki rocks, the latter being but one mile inside the 10-fathoms contour-line of soundings. The bank of soundings extends nearly 40 miles off Mangalore, with a depth of 10 fathoms at 4 miles, 20 fathoms at 10 miles, and 30 fathoms at 18 miles from the shore, muddy bottom, between Mangalore and mount Dilli; above Mangalore the same depths are found much farther off shore.

Surutkul is a small point with a temple on it about 150 feet above the sea, situated 8 miles north of Mangalore; the intermediate shore is straight, sandy, and planted with cocoa-nut trees.

Mulki River entrance, situated 4 miles north of Surutkul, dries nearly across at low water springs, but has 6 or 7 feet on the bar at high water.

See chart, No. 746, and plan on it, of Mangalore.

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The town of Mulki has a church on high ground $1\frac{1}{3}$ miles N.N.E. from the river entrance.

MULKI (Primeira) ROCKS, situated N.N.W. $\frac{1}{2}$ W., 22 miles from Mangalore lighthouse, and 4 miles from the mainland, are of black basalt, elevated in parts 50 feet above the sea. The channel between them and the mainland is clear, but contracted to 3 miles by Cahp rocks, partly above water, lying $1\frac{1}{2}$ miles off shore, north-east from Mulki rocks. Three miles east of Mulki rocks, there is a small detached rock, abreast Uchil Guda hill.

Cahp battery, 2 miles N. by W. $\frac{1}{4}$ W. from Uchil, is an old rock fortification, from which the outermost Cahp rock bears W. by N. $1\frac{1}{2}$ miles. There is an old temple, named Cunjar Guda, within a fort on an isolated hill, 280 feet high, 4 miles north-eastward of Cahp battery.

LIGHT.*—A lighthouse, 120 feet in height, white masonry, is being erected on a rock near the Cahp battery, and a light established. The light will be *group flashing white* showing *three flashes* every *ten seconds*, elevated 140 feet above high water, and visible in clear weather seaward from a distance of 18 miles.

Approximate position, lat. 13° $13\frac{1}{2}'$ N., long. 74° $43\frac{1}{2}'$ E.

Rocks awash.—Four miles N. by E. from Mulki rocks, and 2 miles from the shore, there is a patch of dangerous rocks awash, with 5 fathoms close around; from these rocks Cunjar Guda bears East. At $1\frac{1}{4}$ miles north-east of the rocks awash there is a solitary black rock above water, with detached sunken rocky heads, to the westward of it.

St. Mary isles, in lat. 13° 20′ N., long. 74° 41′ E., consist of three small basaltic islets; Deria Bahadur Ghur, the middle and highest, is 70 feet above the sea; there is a growth of long grass and creepers on some parts of them. The channel between these islets and the sandy beach is about a quarter of a mile wide, with depths of 6 to 12 feet.

There is a good landing place on the east side of Deria Bahadur Ghur, and water can be obtained at all times.

A vessel working to the northward on this part of the coast should not shoal under 8 fathoms by day or 12 fathoms by night, and proceeding southward not under 15 fathoms.

Anchorage.—Small coasting vessels will find shelter from north-west winds between Deria Bahadur Ghur and the the shore; the best anchorage is in 3 fathoms, sand and mud, with the highest part of Deria Bahadur Ghur bearing N.W.

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* Will probably be exhibited in June 1899, when the fixed light now shown from the tower on the hill at the back of Mangalore, will be discontinued.

See chart, No. 745.

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Mulpi river, is half a cable wide at the entrance, and shallow, but is well protected by St. Mary isles. The land at the back rises gradually, and Mulpi church, 3½ miles E. ¾ S. from Deria Bahadur Ghur, shows well in the afternoon; there is a tall chimney here which can be seen from a long distance.

A dangerous rock with 5 feet water, named Adjukal, on which the sea only breaks during a westerly breeze, lies N. 53° W. 1½ miles from Mulpi custom house.

LIGHT.—A *fixed white* light is exhibited from a steel mast on the beach at north side of river entrance, at an elevation of 53 feet above high water, and should be visible seaward from a distance of 6 to 8 miles in clear weather when bearing between N. 22° W. and S. 22° E., except when obscured by St. Mary isles. The light is shown from 1st October to 31st May inclusive.

Wudapi (Oodapi) is the principal town on Mulpi river; it is an important Missionary station, and contains three large Brahmin temples roofed with copper, besides the English church.

Cocoa-nut island, lying 2½ miles N.N.W. from Deria Bahadur Ghur, and about 1½ miles from the shore, has rocks extending one mile westward from its highest part. There is a patch of rocks awash 2 miles north-west of Cocoa-nut island, and other rocky patches 3 miles N.W. ½ W., from the island.

Water can be obtained by digging.

Barkur (Silanadi) River mouth is 8 miles north from Deria Bahadur Ghur, and northward of it the coast is clear of outlying rocks until off Kundapur.

There is a depth of 7 to 8 feet on the bar at high water springs. Small native craft anchor in 2 to 3 fathoms on the west bank, about one mile within the entrance.

LIGHT.—At Hangarkotta, on the southern side of entrance to Barkur river, is exhibited from a masonry column, 12 feet above high water, a *fixed red* light, which should be seen in clear weather a distance of 8 miles. The light is visible from North, through East, to South, but is obscured by trees from South to S. 9° E. and by St. Mary isles from N. 15° E. to N. 9° E. and from N. 5° E. to North. It is shown from 15th September to 31st May.

KUNDAPUR RIVER, situated 18 miles north from Deria Bahadur Ghur, and only navigable by boats, has a depth of 10 feet on the bar at high water springs. There is a reef running out westward of the

See chart, No. 745.

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entrance, on which the sea breaks at the distance of two miles; upon it is a rock, half a mile from the outer tip, which barely covers at high water.

LIGHT.—From a steel mast 40 feet high, on the southern side of river entrance, a *fixed white* light is exhibited at an elevation of 45 feet above high water, visible in clear weather from a distance of 8 miles. The light is visible seaward from S. 34° E. to N. 34° W., and is shown from 15th September to 31st May.

Anchorage.—The entrance of the river is only distinctly seen when bearing northward of East. Vessels should approach with the north point of entrance bearing N.E., and anchor in about 3½ fathoms, when the rock on the reef bears N.W. by N., or further out according to draught. The 5-fathoms contour-line passes close outside the breakers on the reef.

During the north-east monsoon, boats drawing 3 to 5 feet should steer for the south shore of the entrance until the only red brick house bears N.N.E., and is seen just open to the left of a small hill having a cocoanut tree on its summit. Then steer for the red house until a white house conspicuous amongst the palms on the west shore of the river bears N. by W., when the latter should be steered for, and the deep water will be found following the western shore.

The Coast.—At a distance of 2 miles N.N.W. from the entrance to Kundapur river, there is a small rocky point; and one mile farther north-west a sandy point, off both of which rocks extend a mile, or nearly to the 5-fathoms line of soundings.

From Kundapur river the sandy coast trends in a northerly direction 14 miles to Bindur head, 4 to 5 miles south of which are some dangerous rocks awash, with 6 and 7 fathoms close around, situated 3 miles from the shore. To the west and north-west of Bindur are other rocks at about the same distance. Care is therefore necessary when navigating this part of the coast to give them a wide berth.

Bindur river, which has a depth of 8 feet on the bar at high water springs, and is only navigable for small boats, empties itself into the sea just south of Bindur head. This head may be considered the boundary between North and South Kanara, and from it table-land extends back for some distance inland.

NORTH KANARA.—The coast of North Kanara lies between lat. 13° 53′ N. and lat. 14° 54′ N., and though generally sandy, is in some parts rocky, with bold headlands and several small islands; the coast line is broken by the estuaries of four rivers and the mouths of several small streams, through which the salt water finds entrance into numerous lagoons winding several miles inland.

See chart, No. 745.

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Aspect.—The land near the coast shows as detached parts of table-land, easily recognised as such in the morning, when the mist hangs in the valleys; scattered here and there are round hills of about equal height.

The mountains of Nagar or Bednur approach within 6 miles of the sea about here, and have some beautiful peaks more than 3,000 feet high; Yelgetti Guda, the southernmost, 2,950 feet, is a sharp peak, 7 miles east from Bindur head, and conspicuous to a vessel approaching from the northward.

Barsilur peak is a round mountain 3,600 feet high and 9 miles from the sea, but does not show much over intervening elevations except at a distance from land.

Kodachadri (Kollur), 4,411 feet above the level of the sea, is a magnificent sugar-loaf peak, 17 miles N.E. ½ N. from Kundapur, standing isolated and distinct, but it disappears behind other elevated land when bearing southward of East.

Huddi point.—White Rocks.—From Bindur head the shore trends north-westerly 5½ miles to Huddi point, off which there are several dangerous rocks. At 2¼ miles S.S.W. ¾ W. from Huddi point lies Single White rock above water, with depths of 6 fathoms close around, and 2 miles S. by E. ¼ E. from this rock there are two white rocks close together above water. Half a mile southward of the latter there is a rock awash, between which and Bindur head there is a submerged patch.

BHATKAL DRUG is a small fort on a rocky point 1½ miles to the north-west of Huddi, at the entrance of a small river. The town stands one mile up the river, and was formerly a place of considerable trade, known as Baticala. The majority of the population are Mussulmans, and are named Nawayat, many of whom are wealthy traders, and go away for trading purposes, leaving their families behind.

The place is only used by coasters, but a vessel may anchor about a mile off shore, in 6 fathoms, mud, with Bhatkal fort bearing north-east.

LIGHT.—From a mast 20 feet high, on the hill north of port, a *fixed white* light is exhibited at an elevation of 100 feet above high water, visible in clear weather from a distance of 8 miles, when bearing from S. 56° E., through east to N. 11° E. The light is shown from 1st October to the end of May. It is obscured in the direction of Single White rock and Hog island.

HOG ISLAND (Jali Kund), in lat. 14° 0′ N., long. 74° 28′ E. is a peaked island, 365 feet high, having rocks awash extending from it in a south-easterly direction for half a mile. At 1½ miles N. by E. from the island there are also rocks awash, and midway between, a small

See chart, No. 744.

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rocky islet: on its west side Hog island may be approached to half a mile, or a depth of 7 fathoms.

PIGEON ISLAND (Netrani), situated nearly 9 miles W. ¼ N. from Hog island, is a round flat-topped island 335 feet high, nearly half a mile across, and is visible 20 miles in clear weather; two cables off its south-west part lies a small islet. Pigeon island is steep-to, and stands about one mile within the 20-fathoms contour-line of soundings; it has 25 fathoms at the distance of 5 miles to seaward.

A vessel might get a little shelter on its south-east side during a north-wester in a depth of 15 fathoms, mud.

Modeshwar is a small projecting rocky cape, 5 miles north of Hog island, one mile south-west of which lies a small rocky islet 32 feet high, near the edge of foul ground continuing to the shore. At the distance of 3 miles N.E. by N. from Modeshwar is the western hill of a spur from the Coorg mountains, named Kotaguda, a saddle-back hill, 1,450 feet above the sea.

Dart rock, on which the sea breaks only during heavy weather, is about a quarter of a cable in extent, with a depth of 9 feet upon it, and 6 fathoms, mud, around. From Dart rock, Modeshwar point bears E. by N. ¼ N. 2 miles, and Hog island S.S.E.

A **buoy** is moored a short distance E. by N. from Dart rock.

Hawkins reef is a ledge of rocks extending off the shore north of Modeshwar, from the outer extreme of which the point bears S.E. ¼ S., and is distant one mile.

Munki Drug is a fort-like hill overlooking a small sandy bay, 6½ miles N. by W. ½ W. from Modeshwar, where small coasters find some shelter from north-westers. This rocky cape, 2 miles in length, is of table-land formation, about 250 feet above the sea, its northern part rising to an elevation of 450 feet; above the cape there is a sandy shore to Honawar river.

Honawar, in lat. 14° 17′ N. long. 74° 26′ E., is a seaport town on the north bank of an extensive estuary, which at its south-eastern extremity receives the Gersoppa or Shirawati, a considerable river flowing from beyond the Western Ghats.

Honawar has become of little importance, trade now finding its way to Karwar and Bombay.

LIGHT.—A *fixed white* light is exhibited from a mast at an elevation of 23 feet above the sea on the sand north of Honawar river entrance, and is visible from a distance of 6 miles, between the bearings of S.E. (through east) and N. 14 W.

See chart, No. 744.

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The light is shown from the 1st October to about the end of May.

Anchorage may be obtained in 5 or 6 fathoms, mud, off the entrance to the estuary with the monument which stands half a mile eastward of the town in line with the river mouth, bearing about E.N.E.

BASWARAJ DRUG (Fortified Island), 184 feet high, situated 2 miles northward of Honawar, and half a mile from the shore, consists principally of ironstone. The island has on it some ruined fortifications, and is covered with a growth of brushwood; small coasters find shelter under the lee of this island from the north-westers.

Ravana Gundi, about 3 miles north of Baswaraj Drug, is a rocky headland, about 500 or 600 feet high, which, when seen from the westward, has the appearance of a large saddle hill, and shows well at night.

KUMPTA POINT forms a small bay on the north side of the entrance to Kumpta creek, sheltered from north-west winds; but the water is too shallow for even coasting craft to remain, and those that are too large to enter the creek at high water, anchor in 3 or 3½ fathoms, sand and mud, southward of the point.

Town.—Kumpta is the chief commercial town in Kanara district, and contains sub-judge's court, post office, dispensary, &c. Its trade consists chiefly of cotton, spices, and grain; a few articles of carved sandlewood are manufactured and exported to Bombay.

LIGHT.—On Kumpta point stands a tubular mast from which, at the elevation of 116 feet above the sea, is exhibited a *fixed white* light, visible in clear weather from a distance of 12 miles.

Position.—Latitude 14° 25′ N., longitude 74° 23′ E.

Snail Rock.—About 1¾ miles northward of Kumpta point, and one mile from the shore, there is a rock above water, named Snail rock, from its resemblance to a snail when viewed from the northward.

TADRI RIVER, situated 6 miles north of Kumpta point, empties itself in a bay formed on the south side of a cape, the summit of which, Flagstaff hill, is 440 feet high. This projecting land affords shelter from north-west winds to vessels anchoring off the mouth of the river. On the east side of the entrance is the old fort of Rajahmun Drug, 300 feet above the sea; and on the hill, north-east of the fort, two beacons 410 feet above the sea, which, when in line, lead over the bar.

The town of Tadri stands on the north bank a little way within the entrance of the river, which is not navigable by vessels any distance; small boats can go to Cutgal 12 miles, and canoes as far as Ospenpatan, 20 miles, above Tadri.

See chart, No. 744, and plan on it, of Tadri river.

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On the north-west extreme of Tadri high land, and close to the sandy shore, lies the famous town of Gokarn, with many large temples, and tanks of fresh water; this is a place of great repute among the Brahmins.

LIGHT.—From a mast, 20 feet high, a *fixed white* light is exhibited at an elevation of 100 feet above high water, on a hill north of Tadri river entrance, and is visible from a distance of 8 miles, between the bearings of east through north, to N. 17° W. It cannot be seen in the direction of Snail rock.

The light is shown from the 1st October to the end of May.

Navigable depths.—There is a depth of 7 feet on the bar of Tadri river at low water ordinary springs; 13½ feet at high water springs, and nearly 15 feet at extraordinary springs, with the night tide during the fine season; and 11 feet at high water neaps.

Anchorage.— Large vessels may anchor off the bar in 4½ fathoms, mud, with the beacons on Rajahmun Drug hill bearing E.N.E., and the outer cape of Tadri N.W. ½ N. The local authorities will arrange for entry into the river.

Tides.—It is high water, full and change, at the bar of Tadri, at 10 h. 0 m.; ordinary springs rise 6½ feet; neaps rise 5 feet. With the night tide in the fine season, springs rise nearly 8 feet.

GANGAWALI RIVER entrance at 6 miles north of Tadri river, is shallow, and rendered tortuous by sandbanks; at half a mile north of the entrance there is a rocky headland, the cliffs of which extend along the shore for 2 miles to north-west, terminating in Kusuldeva Guda cape 550 feet high, having a small bay on its north side, in which there is a reef of rocks.

From the forests, on the banks of Gangawali river, excellent teak timber is floated down (the property of the British government), and carried in native vessels to the dockyard at Bombay.

BELIKERI BAY.—The coast between Kusuldeva Guda and Kawda Guda, a steep rocky cape 6½ miles northward of it, recedes and forms Belikeri bay, 2 miles deep, with general depths of 2 to 3 fathoms; in the northern part of this bay there is shelter for small vessels during north-west winds.

Ankola creek, distant two miles north of Kusuldeva Guda cape, is dry in the entrance at low water; the town of Ankola is one mile from the mouth, and has a bazaar and many temples.

Belikeri point, 3 miles northward of Ankola creek, with a large bungalow amongst trees upon it, is low, flat, and rocky, and projects westward on the

See chart, No. 744.

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south side of the entrance to Belikeri river, one mile off the entrance to which lies Kukra, a small wooded island almost connected by rocks to Belikeri point.

Northward of Belikeri bay there is very high undulating land, about 1,700 feet above the sea; the low valley of Belikeri river extends to the north-east for many miles, and shows in striking contrast to the high lands on either side.

Tulsiparwat is a peaked hill, with a black top, 1,680 feet high, 4 miles N.E. by E. of Ankola.

AURIGI CAPE, situated 3½ miles north-west of Kawda Guda, has, at two cables south of it, a high, rocky, wooded islet, and at 1¼ miles S. by W., a small black rock, named Button, which has 6 fathoms close to. On the east side of Aurigi there is a sandy bay, named Kawda, 2 miles wide, and nearly one mile deep, with 2 to 4 fathoms water. A submerged rock lies 3 or 4 cables eastward of the wooded islet.

Chendia village lies 1½ miles inland from Aurigi cape.

ANJEDIVA ISLAND, situated 2 miles westward of Aurigi, and belonging to the Portuguese, is three-quarters of a mile long, south-east and north-west; its northern end, 200 feet above the sea, has cocoa-nut trees on the summit. The western side of the island is rocky and barren; on the east side there are houses and a fort with a flagstaff. At half a mile east of Anjediva there is a small rocky islet named Round islet, about 40 feet high.

Anchorage may be obtained in 5 fathoms, mud and sand, to the east of the fort, where vessels have ridden out the south-west monsoon, as the island forms an excellent breakwater. At that season a strong current runs to the south-east.

Bingi bay, eastward of Anjediva island, affords shelter in 3 to 4 fathoms, for small vessels against north-westers. Water and firewood can be obtained.

KARWAR HEAD (Walgudda), situated nearly 3 miles N.N.W. of Anjediva island, is 660 feet high, densely covered with jungle, and has 4¾ fathoms close to the cliffs. Midway between this head and Bingi bay, Buitakode point, projects nearly half a mile between two small sandy bays. At 4 miles east of Karwar head lies Godhulli peak, 1,800 feet high, which may be seen in clear weather from a distance of 40 miles.

Mogera guda (Elephant) island, 100 feet high, situated half a mile south-west of Karwar head, is rocky, covered with jungle, and has depths of 5 and 6 fathoms around, and between it and Karwar head.

See plan of Sadashivgad bay and river, No. 243.

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Gudsar sunv (Karwar rock), with 9 feet least water, and 7 fathoms close around, lies little over half a mile north-west of Mogera guda island. From the centre of this rock, the west extreme of Karwar head, bears E.N.E., and the lighthouse on Deogarh island, N.W. ¾ N. On the west side of Karwar head there are two white boulders; the lower boulder has a vertical red stripe; these in line lead over Karwar rock.

OYSTER ROCKS, situated with their nearest end 1¼ miles W.N.W. from Karwar head, consist of a cluster of islands and rocks, one mile in extent east and west. Deogarh, the north-westernmost and largest of these islands, is 160 feet high, having on it a lighthouse, a signal station, and a few other buildings. It is bold, rocky, and slopes gradually towards the west; the summit is covered with jungle. On the west side of this island there are depths of 7 and 8 fathoms within a short distance of the rocks. Landing can be effected on the east side of Deogarh during fine weather.

Karkal, the island next eastward of Deogarh, is 100 feet high, covered with jungle and surrounded by rocks. At 3 cables east of Karkal lies East island, 30 feet high, bare and rocky; at 1½ cables east of this island lies a rock awash, on which, at high water, the sea does not break during the fine season, and care must be taken to give it a wide berth. Mudhulla hill, in line with the summit of Kurmagad island (N.E. by N.) leads south-east, and the west extreme of Anjediva island, seen just over the east extreme of Mogera guda, leads north-east of this rock.

A red buoy is moored in 6½ fathoms water, one cable south-east of the rock.

LIGHT.—From a circular white tower, 72 feet in height, standing on the summit of Deogarh, is exhibited, at the height of 210 feet above high water, a *fixed white* light, which should be seen in clear weather from a distance of 20 miles.

Position.—Latitude 14° 49′ N., longitude 74° 3′ E.

Anchorage.—During north-westers, vessels may anchor on the south side of the Oyster rocks, in 7 fathoms, mud, 3 or 4 cables from them, with the lighthouse bearing N.W. by W. ½ W., and Kurmagad open eastward of East island. In the south-west monsoon there is anchorage on the north side in 6 fathoms, mud, with the lighthouse bearing W.S.W. and East island S. ½ W.

Sailing vessels making Port Karwar at night, should anchor near the Oyster rocks, and wait for daylight.

Parker rock (Outer rocky patch), the position of which is doubtful, is about 50 yards in length, and 20 yards across; it is composed of rock

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See plan of Sadashivgad bay and river, No. 242.

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and shells, and has 2½ fathoms on it at low water. From the assigned position Deogarh lighthouse bears S.E. ½ E., distant about 2½ miles; and Black rock N.E. ½ N. There are 8 and 9 fathoms close round this shoal.

A red buoy is moored on the west side of Parker rock.

SADASHIVGAD BAY, situated between Karwar head and Loliem point, at 7 miles north of it, has general depths of 4 to 6 fathoms, bottom chiefly composed of mud. On the south side of this bay lies Port Karwar (Bhatkul cove) a small but safe haven, where the Indiamen used formerly to careen.

Buoy.—A red buoy ismoored at about 1½ cables N.W. by W. ½ W. from Bluff point, on the western side of entrance to Bhatkul cove, between which and the shore lies Bhatkul rock, having upon it a depth of 6 feet.

Konay.—A short distance north-east of Bhatkul cove stands the town of Konay, and on the beach there are some well-constructed bungalows, behind which lie the bazaar, collector's kutchery, police lines, jail, and hospital. There is a telegraph and post office at Konay.

Exports.—The principal exports are raw cotton, grain, timber, and myrabolams.

Imports.—The chief imports consist of raw silk, cotton, yarn, metal, and gunny bags.

Supplies.—Mutton is plentiful, and supplies of all kinds can be obtained in the bazaar. Good fresh water can also be procured.

Storm Signals.—For details, *see* page 56.

LIGHT.—A *fixed red* light, elevated 65 feet above high water, is shown from a flagstaff at the port office at Konay, and should be visible in clear weather from a distance of 3 miles, when bearing from S. 78° E. to S. 38° E.

Anchorage.—Along the north cliff of Karwar head vessels can anchor in 4 fathoms water at 2 or 3 cables from the shore, sufficiently sheltered from the south-west monsoon to enable them to load or discharge cargo.

The inner anchorage at Port Karwar is in 3 fathoms, with Ambari sunv (Fisherman's rock), 5 feet high, bearing W. ¾ N., and the landing jetty, south.

At night, the red light on the port office may be steered for when bearing S.E. by E. ½ E., until in the required depth, 5 to 3½ fathoms; then anchor.

See enlarged plan of port Karwar, on plan, No. 242.

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Sadashivgad (Kalinadi) river empties itself into Sadashivgad bay, at 2 miles north of Karwar head; the entrance is much encumbered with sandbanks, some of which dry at low water, and the channels change frequently. On the summit of Sadashivgad hill, 218 feet high, situated on the north bank of the river just within the entrance, are the remains of an old fort, and on Sanvar paiguda, a hill a short distance to the eastward, are the ruins of another fort; north of these hills stands the town of Sadashivgad. The south side of the river is low, and on Shitta, the south entrance point, there is a conspicuous palm tree. About half a mile east of this point there is a small jetty and a custom house; whence a ferry runs across to the north bank, outside which there is a cluster of rocks dry at low water, and marked by iron beacons. The town of Karwar stands on the right bank of a small creek on the south side of the river, at $2\frac{3}{4}$ miles within the entrance.

Shimis guda (Sunghiri) island, 139 feet high, lies nearly 2 miles north from Karwar head; landing can be effected in a small sandy bay on the south-east side of the island, but it is difficult of access, being generally steep-to.

Kurmagad island, 197 feet high, lies 3 cables north-east of Shimis guda. This island has been fortified all round; within the fort, there is a well of fresh water amongst some trees on the eastern side. Eastward of this island the water is shoal to the river entrance, and several of the sand banks dry at low water. Between Kurmagad and Shimis guda there are depths of $3\frac{1}{2}$ and $4\frac{1}{4}$ fathoms.

Black rock (Kumbae), situated $4\frac{1}{4}$ miles north of Oyster rocks, is a small rocky islet with depths of 4 fathoms close around.

Loliem rocks.—At about $1\frac{1}{4}$ miles W.N.W. from Black rock, and three-quarters of a mile south of Loliem point, lies Loliem rock, awash at low water spring tides; at 2 cables N.N.E. $\frac{1}{2}$ E. of Loliem rock there is a sunken rock, both of these have a depth of 5 fathoms close around. Godhulli peak, in line with the south-west side of Kurmagad island, bearing S.E. $\frac{1}{2}$ E., leads southward of these rocks.

Loliem point, the north extreme of Sadashivgad bay, is a steep rocky cape, well-wooded, 400 to 500 feet high, increasing in height to the eastward. In a small sandy bay, at $2\frac{1}{2}$ miles east from the point, is the village of Polem (Polay), which is the border town of the Portuguese, and has a custom-house with a military guard.

Boundary.—The boundary line between Portuguese and British territory passes eastward from Polem through the summit of a round hill,

See plan of Sadashivgad bay and river, No. 242.

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1,250 feet in height, named Bomguda, between 6 and 7 miles east from Loliem point.

Tides.—It is high water, full and change, at Port Karwar in Sadashivgad bay at 10 h. 36 m.; springs rise 6¾ feet, neaps rise 4½ feet.

The tides are subject to a large diurnal inequality which may accelerate or retard the times of high and low water, sometimes to the amount of one hour or more, and increase or diminish the rise by upwards of one foot.

Directions.—During the south-west monsoon sailing vessels, whether from Europe or the bay of Bengal, bound to Sadashivgad, must pass westward of the Maldive and Laccadive islands. When in the latitude of mount Dilli, they may edge away to the N.N.E., and endeavour to make cape Ramas, a bluff high cape, 20 miles N.W. by N. from Karwar head, which is steep-to and free from off-lying dangers. The edge of the bank of soundings is about 45 miles off this cape; 30 fathoms, mud, at 16 miles, 20 fathoms, mud, at 9 miles, and 10 fathoms at 1½ miles.

At this season the current sets strongly to the southward; the land should be made at daylight.

Cape Ramas projects one mile west of a high bluff, named False cape Ramas, that is visible in clear weather from a distance of 25 miles, but during the thick weather of the south-west monsoon no part of this coast would probably be seen more than 4 or 5 miles.

Between cape Ramas and Sadashivgad bay the coast is undulating, forming several bays; the soundings decrease regularly towards the shore.

In running for port Karwar, during the south-west monsoon, a vessel should pass west and south of Oyster rocks, for if passing north-east of them, under shortened sail, a vessel would probably drop to leeward in the heavy south-west swell. At this season the strong current setting down the coast, at right angles to the swell and wind, is pressed into Sadashivgad bay, and runs out westward along the north side of Karwar head. During the north-east monsoon the port may be approached from any direction, and a vessel can work, or run in, according to the wind.

When entering port Karwar from the southward, the summit of Mudhulla hill must be hidden behind the top of Kurmagad.

Anjediva and Oyster rocks are steep-to on their sea face, and 10 fathoms water is found about 1½ miles from them, 20 fathoms at 9 or 10 miles, and 30 fathoms at the distance of 18 miles.

See plan, No. 242.

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GOA COAST.—The Portuguese territory of Goa extends from lat. 14° 54′ to lat. 15° 43′ N., and consists of sandy bays fringed with cocoa-nut trees, separated by several rocky capes.

The coast from Loliem point trends northerly 4 miles to Talpon river, thence north-westerly 3½ miles to Paidegal point, a steep, projecting rocky headland. Above Talpon is the town of Canacona, the capital of the district of that name, and a military station. Off the sandy bay of Canacona, and south of a small rocky island close to the shore, good shelter may be obtained against north-westers for small vessels, in 3 or 4 fathoms, mud.

Paidegal village lies on the north side of Paidegal point, north of which the coast is sandy for 1½ miles; thence rocky to cape Ramas.

CAPE RAMAS (Cabo de Rama), situated 6 miles N.W. ¼ W. from Paidegal point, and 18 miles N.N.W. ½ W. from the outer Oyster rock, is prominent table-land, 200 feet high, having on it a fort, from the flagstaff of which the Portuguese generally show their colours to passing vessels. The landing-place at cape Ramas is in a small sandy bay on the north side of the fort, and nearly one mile east of the cape. There are two springs, one warm, the other cold water, near the landing-place.

Small vessels obtain shelter from north-westers, in 5 or 6 fathoms, mud, close under the south side of the fort, where the shore is steep-to.

LIGHT.—A *fixed white* light is exhibited on cape Ramas, which, elevated 19 feet above the ground, and 203 feet above the sea, is visible seaward in clear weather from a distance of 15 miles.

Position.—Lat. 15° 5′ N., long 73° 54′ E.

Ramas False Bluff, one mile south-east from cape Ramas, is elevated about 700 feet, and falls abruptly on the table-land of the cape. From this drop the land rises gradually to the eastward in a succession of four or five hills, for the distance of 4 miles, and terminates in East peak 1,470 feet above the sea; thence there is a gap through which the main road between Kanara and Goa lies, and beyond this are the mountains of Canacona, 2,020 feet high.

Sal river.—Between cape Ramas and Moliem point, 1½ miles north of it, the land recedes and forms a small bay, and at 2½ miles north-east of Moliem point there is a flat rocky point, on the north side of which lies the mouth of the Sal river, a considerable stream, but only available for small coasting vessels. Chandernat, a white pagoda, on a hill 900 feet above the sea, is situated about 6½ miles north-east of the river mouth.

See charts, Nos. 744 and 740.

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Colla bay.—From Sal river the coast trends nearly straight in a northerly direction 14 miles to Colla bay, and consists of low cultivated land, with several churches on some small hills. From the river mouth for this distance, the 10-fathoms contour-line of soundings lies parallel with and about 5 miles from the shore, decreasing gradually to 5 and 4 fathoms, mud, within a mile of the beach. During north-west winds Colla bay affords sheltered anchorage in about 4 fathoms water.

ST. GEORGE ISLANDS, situated southward of Murmagao headland, consists of three small islands, the two southern of which, known as East and West St. George islands, lie about 4 miles west of Colla bay. These islands are nearly connected at low water by a narrow neck of rock and shingle, and together extend nearly 1½ miles in an east and west direction.

West St. George island, 247 feet high, is of a conical shape, bold, rocky, and covered with jungle towards the top. There are depths of 5 fathoms close to the west side; landing can be effected on the north-east side, and good water obtained from a spring on the south side. At 8 cables W. by N. ½ N. from this island lies St. George patch, with 5½ fathoms, and 7 to 10 fathoms close around.

East St. George island, one mile long, and from 2 to 4 cables wide, rises gradually from west to east, where it attains the height of 236 feet; the top of the hill and the north side of the island is covered with jungle. The landing place is in a small cove at the south-east extreme, where there is a small well of good water, close to a solitary cocoanut tree. At 2½ cables eastward of this island lies St. George reef, a dangerous rocky patch, parts of which dry 3 to 4 feet at low water, with 8 fathoms close round.

The north side of these islands is fringed by shoal ground, which extends 2 to 3 cables from them; detached reefs and islets extend for some distance along the south side of the islands parallel to the shore, which have deep water close-to.

Sail rock is a pillar rock, 43 feet high, 4 cables southward of West St. George island, and at a short distance may easily be mistaken for a sail. Between Sail rock and the West island there is a patch of rocks that dry 2 feet at low water.

Anchorage.—Southward of East St. George island, vessels will find shelter from N.W. winds in 10 fathoms, mud.

Martha patches.—Between East St. George island and Cumbariem rock, at 2¾ miles north of it, there are several rocky shoals, named

See plan, Aguada to St. George islands, No. 492.

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Martha patches, with 3¾ to 5 fathoms water. The general depths around these patches are 5¼ to 7 fathoms.

Small St. George island, situated about 1½ miles north-east of East St. George island, and 5 cables from Bimbay point, is a round, flat-topped, precipitous island 169 feet in height, covered with jungle, and steep-to; in the channel between this island and Bimbay point there are depths of 4½ to 5¼ fathoms; and in the channel between Small and East St. George islands there are depths of 5 to 6 fathoms.

Cumbariem (Buffalo rock), 20 feet high, situated nearly one mile S.W. by S. from Murmagao point, is composed of trap and laterite, and owing to the large amount of iron in the laterite, the compass is so disturbed that accurate bearings cannot be obtained on it. There are depths of 5 fathoms close to the south and west sides of this rock, but shallow water extends 1½ cables from the north-east side.

Sawyers patch, with 19 feet water and 5 fathoms close around, lies 4 cables N. ½ E. from Buffalo rock, and half a mile from the nearest land.

Murmagao headland, the southern entrance point of Murmagao bay, is a peninsula connected with the mainland by a neck of sand about a quarter of a mile across. It is of table-land formation, 1½ miles long north-west and south-east, and 243 feet high, with precipitous sides, especially on the west face; the greater part of the north, and the whole of the east side, is fortified, the fortifications terminating to the north and west in a fort built on the side of the hill. This fort is mounted with guns of an obsolete pattern, and garrisoned by about sixty officers and men, who guard the fortress, which is used as a convict establishment.

A short distance south-east of the fort there is a landing slip in a small cove. East of the headland, in a small sandy bay, lies the fishing village of Murmagao.

MURMAGAO HARBOUR lies on the north side of Murmagao headland, and affords good anchorage in 4¼ fathoms water, eastward of the breakwater, which extends from the shore midway between the fort and Murmagao point; small vessels may anchor in 3½ fathoms further to the eastward. A quay, 1,200 feet long, extends from the inner part of the breakwater to abreast the fort, with depths of 23 feet, soft mud, close alongside. The bottom of the harbour is found to silt up nearly a foot during the south-west monsoon, and is re-dredged in the fine season. The breakwater runs out in a N. by E. direction 1,176 feet, and a rubble mound, with a depth of 18 feet over it, extends 624 feet beyond.

See plan, Aguada to St. George islands, including Murmagao and Goa roadstead, No. 492.

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LIGHT.—A *fixed red* light is shown at the end of the breakwater during the north-east monsoon.

Buoys.—A can buoy, painted black, is moored on Murmagao rock.

A conical buoy, painted red, marks the end of the rubble mound continuing northwards from Murmagao pier.

Three buoys, painted white, are moored in 4¼ fathoms at half a cable northward of Murmagao quay; there appears to be less water outside the buoys.

A conical-buoy, painted red, is moored northwards of Ida bank, at about 4 cables, E. by S. ½ S. from the fort flagstaff.

Trade.—The value of the **exports** by sea (1896) including those for transit, amounted to 1,569,476 rupees. The value of the **imports** by sea, including those for transit, amounted to 2,528,664 rupees. The above were dealt with by the Murmagao custom house. The principal articles of export are cotton-stuff, cocoa-nuts, salt, dried fish, betel-nut and timber; of import, grain, wine and spirits, coir, metal, mineral oils, preserved provisions, and sugar.

Shipping.—During the year 1896, there entered the port of Murmagao, 827 vessels with an aggregate tonnage of 145,320.

Supplies.—Fish, beef, and poultry are plentiful, and supplies of all kinds can be obtained at moderate rates.

Coal.—The West of India Portuguese Railway Company keep a small stock of coal at Murmagao, and will supply Her Majesty's ships if they can spare any.

Murmagao rock, about one cable across, has 23 feet least water on it, with depths of 5 fathoms close around, and lies N.W. 7 cables from Murmagao fort; it is the southernmost danger of the Amee shoals.

Amee shoals extend one mile in a north and south direction, and nearly the same distance east and west; the shoalest part, with 9 feet water, bears from Murmagao point N. by W., distant 1¼ miles.

Sunchi reefs, situated a quarter of a mile north of Amee shoals, are dangerous rocky patches, several of which dry at low water; the outer rock lies S.S.W. distant one mile from Cabo point, and dries at low water springs. In the channel between Amee shoals and Sunchi reefs there is a depth of 5½ fathoms. At 1¼ cables north-east of Sunchi reefs lie the Malvere patches of 1¼ fathoms, having in the channel between, 4¾ fathoms water.

In the south-west monsoon the sea always breaks heavily over Amee shoals and Sunchi reefs.

See plan, No. 492

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Secretario island.—The coast between Murmagao headland and Chiquilim point at 2½ miles east of the fort, forms the south side of Murmagao bay, the shore being mostly bold and rocky, and rising at the back to tableland 100 to 150 feet high. Secretario island lies 1¼ miles east of Chiquilim point, and is nearly circular in shape, a quarter of a mile in diameter, flat-topped, precipitous, and covered with dense jungle. It is connected with the mainland by a mud flat which dries at low water spring tides. On the south side are the remains of the church of St. Jacinto and some fortifications.

Vareeg islet, 10 feet high, lying 5 cables west of Secretario island, is connected with the mainland at low water by a narrow neck of sand.

The Juari river, 39 miles in length, rises at the foot of Digni Ghat, in the province of Embarbakam, runs northward, separating Salsette from Ponda, and falls into Murmagao bay north of Secretario island. This river is only navigable by boats.

Cabo point, the western extremity of Goa island, and the north entrance point of Murmagao bay, is a conspicuous headland 198 feet high, covered with jungle; on it stands a large building used as the summer palace of the Viceroy. There is a small English cemetery on the south slope of the cape.

The south side of Cabo point consists of precipitous laterite (sandstone) rocks, off which reefs and shoals extend to a distance of 3¼ cables. There is a small landing-place in a sandy cove, three-quarters of a mile east of the point, near the village of Malvere.

Cabo rock, with 7 feet over it at low water, lies W.S.W. nearly 6 cables from Cabo point, and between is Cabo reef, part of which is awash at high water. Shoal patches extend 8 cables westward from the point.

Albuquerque rocks, one cable in extent, which are dry at low water, lie 4 cables south of Cabo point, and have foul ground between; there is a heavy swell over them, except at high water springs.

Cankarso island, situated 1¼ miles south-east of Cabo point, is a precipitous rocky islet 50 feet high, connected with the mainland by a reef which dries at low water springs. Rocks extend from it south-westward, nearly 3 cables, with boat channels between.

Donna Paula bay, on the east side of Cankarso island, affords good shelter to small vessels from N.W. winds. There is a landing slip and small fishing village here, and a good carriage road to Panjim and Cobo. From Donna Paula to Nazareth point, the coast is alternately sandy and rocky, the reefs off Orxel and Cacara points extending 1½ cables. The land at the back rises to about 100 feet, and is covered with jungle.

See plan, No. 492.

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Port limits.—The Murmagao port limits extend from Chiquilim point in a W.N.W. direction to Amee shoals, thence S. ½ W. to Murmagao point; south of the headland the limits extend from its south-west extreme to Small St. George island, thence to Bimbay point, including the island and Chicolna bay.

The Donna Paula port limits extend from Nazareth point in a W. by N. direction to Sunchi reefs, thence N. ¼ E. to Cabo point.

That part of Murmagao bay which lies between these port limits is termed the Neutral ground, in which vessels are not allowed to anchor.

Directions.—Vessels bound to Murmagao harbour from the southward should, after passing about half a mile outside West St. George island, steer North until the north cliff of Secretario island is seen just open of Chiquilim point, bearing E. ½ S., which will lead about 2 cables north of Murmagao point, when a more northerly course must be steered between the buoys marking Murmagao rock, and the extension works of the breakwater, which latter must be rounded at a convenient distance for the anchorage.

From the northward, after passing Aguada head at a distance of about one mile, the east cliff of East St. George island in line with Cumbariem bearing S. by E. leads westward of all dangers across the entrance of Murmagao bay, and when the north cliff of Secretario island is seen open of Chiquilim point proceed as before directed for the anchorage.

During thick weather a vessel should not, when between St. George island and Aguada head, shoal into less than 10 fathoms water.

AGUADA HEAD, at 1¾ miles north of Cabo point, is a bold bluff headland 260 feet high, which from seaward appears to have a flat top; it is about 1½ miles long east and west, and half a mile across the broadest part. Where the head joins the mainland to the northward, it is low, sandy, and covered with cocoa-nut groves; here at all times there is a heavy surf on the beach. The whole of the north side of the hill is fortified, and a portion of the south side; the parts not fortified are inaccessible.

There is a fort on the south side of the headland with a flagstaff and signal station; outside the fort is the saluting battery and the houses of the commandant, customs officers, and pilots for the river. Eastward of the fort there is a small landing jetty, where good water can be procured at any time of the tide.

St. Lorenzo chapel on the hill east of the citadel, and a topé of cocoa-nut trees westward, form conspicuous marks from seaward. The shore reef westward of Aguada head does not extend more than three-quarters of a

See plan, No. 492.

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cable, and has deep water close-to; a small head of rock, awash at high water, lies half a cable eastward of Mama point.

LIGHTS.—From a circular white tower, 53 feet high, in Aguada fort is exhibited at an elevation of 280 feet above the sea, a *white* light which *revolves* in *one minute and fifty seconds*, and should be seen in clear weather from a distance of 20 miles.

From a small white tower, about 200 yards southward of the above, a *fixed white* light is shown at the height of 93 feet above the sea, which should be visible in clear weather from a distance of 6 miles.

A *fixed white* light is also shown from a white tower on the north shore to the eastward of Reis Magos fort, at the height of 50 feet above the sea, which can be seen from a distance of 6 miles.

Position.—Latitude 15° 29′ N.; longitude 73° 46′ E.

AGUADA BAY (Goa road), lies between Cabo point and Aguada head; in the outer part it has depths of 5 fathoms, mud, decreasing gradually towards the head of the bay. From Cabo point the shore is high and rocky, and runs south-easterly 7 cables to the head of Caranzalem bay, thence is low and sandy (with extensive fields and cocoa-nut groves behind it) for 1½ miles, in a northerly direction, to Gaspardias fort. This fort stands on the south side of the entrance to Mandavi river, which here is 7 cables wide, though the channel is contracted to less than a cable by sand banks.

Reis Magos fort is at the north entrance point, and is used as a flag-signal repeating station between Panjim and Aguada.

The shore between Aguada headland and Reis Magos fort is fringed with rocks for a distance of three-quarters of a cable. Reis hill, 169 feet high, westward of Reis Magos fort, is bare on top, but the foot and slopes of the hill are covered with cocoa-nut trees and jungle.

Sinquerim river, skirting the north-eastern side of Aguada headland, is about 5 miles long, tidal throughout, and navigable for boats at high water. About one-third of a mile up there is a small Government naval yard, with store-houses and boat-slips.

Mandavi river.—The Mandavi river, 38 miles long, rises at Parvar Ghat, in the province of Satara, runs north-west of Ponda, thence south-west of Bicholim and Bardez, and, after forming several islands, discharges itself into the head of Aguada bay. It is the most important stream in the territory; both the old and new capitals are situated on its banks.

Panjim, the present capital of Portuguese India, is situated on the south bank of Mandavi river, about one mile within the entrance. It is a

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See plan, Aguada to St. George islands, including Murmagao and Goa roadstead, No. 492.

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clean and well-built city, with a sea wall and quay on the river bank, alongside which boats can lie afloat at all times of the tide.

The governor's palace is on the river bank, and near it are most of the public buildings. The church of Nossa Senhora de Conceicas is situated on the north-west slope of Panjim hill, and is conspicuous; part of the town is built on the north spur of this hill, which has a signal station and flagstaff close to the north end, immediately south of which is the Pilot's tree. The most populous and crowded quarter of Panjim, called Fountainhas, is situated on the east side of the hill.

Population.—The population of the territory of Goa in 1891 was 561,384; that of Panjim in 1881 amounted to 14,134.

Winds.—At Aguada, from December to April, land and sea breezes blow with little variation; the land winds last from daybreak to about 9 or 10 a.m. After an hour's calm the sea breeze sets in, but does not generally blow as fresh as the land wind. From the middle of February to the end of March the sea breeze sets in later, generally about 1 o'clock, and draws more to the north-west. At this period there are strong winds from north-east, generally lasting from three to seven days, decreasing at sunset and increasing again at sunrise.

These winds send a heavy swell into Aguada and Murmagao bays, rendering it difficult to land or ship cargo from large vessels.

Tides.—It is high water, full and change, at Aguada at 10 h. 39 min.; ordinary springs rise $6\frac{1}{3}$ feet; neaps $5\frac{1}{6}$ feet. At Panjim high water occurs 25 minutes later. During strong westerly winds the fall of the water is retarded in Mandavi river from one to two hours after the tide has commenced to ebb at Aguada.

OLD GOA, the former capital, situated on the left bank of the river, about 5 miles above Panjim, is a heap of ruins, with about a dozen churches in a state of decay, standing out from among the trees and on the hills. The river bank between Old Goa and Ribandar is fringed with cocoa-nut trees, and remains of old buildings and churches, are still to be traced along the banks.

About midway between Old Goa and Panjim stands the village of Ribandar, the residence of the more wealthy of the officials and better classes of the population; it is connected with Panjim by a causeway, constructed over an extensive salt marsh, south of which are large cocoa-nut groves.

Mapusa and Naroa rivers, named after the principal villages on their banks, join the Mandavi between Panjim and Old Goa, and form the islands of Chorao and Divar, the south sides of which form the right

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See plan, No. 492.

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bank of the Mandavi ; these islands are low and principally artificial, with a frontage of mangrove swamp.

Anchorages.—At about 2½ miles westward of Aguada fort, during the fine season, anchorage may be obtained in 9 fathoms, mud, with Aguada lighthouse bearing E. by N.; white building on Cabo point E. by S. ⅔ S.; and Murmagao point S.E. ½ S. Anchorage may also be found in the same depth, 2¾ miles farther southward, off the entrance to Murmagao river, with Aguada lighthouse bearing about N.E. by N., and Murmagao point, S.E. by E.

Anchorage may further be obtained in 4½ fathoms, mud, abreast Aguada headland, with the lighthouse bearing N. by E., about three-quarters of a mile from shore; small vessels may close into 3½ fathoms, mud, with the lighthouse bearing N.W., and Mama point N.E. by E.

In Aguada Roads the flood tide is scarcely perceptible ; the ebb runs strong out of the river, but at the anchorage off Aguada lighthouse the velocity is one knot per hour. When the wind sets in strong from the westward there is a heavy swell in the Roads, and heavy breakers on the bar.

Goa River (Mandavi).—Navigable depths.*—The bar at Goa river entrance during the fine season has a depth of 13 feet at low water springs, 19 feet at high water springs, and 18 feet at high water neaps; in the south-west monsoon heavy breakers extend across the bay, and the river is inaccessible.

Leading Marks.—Lights.—Small white towers about 34 feet in height, from each of which is shown at night a *fixed white* light, visible from a distance of 6 miles, are erected as leading marks for guiding vessels over the bar. One of these towers is situated on the beach close to the old slaughter-house, half a mile northward of Gaspardias fort, and the other on Pilot's bluff at the back of the town of Panjim. These towers, or lights, in line bearing N.E. by E. ½ E., lead in the deepest water over the bar.

It is compulsory to employ a government pilot, who will board from Aguada.

Chapora river.—The coast from Aguada headland trends in a northerly direction 7 miles to Chapora river, which is 18 miles in length ; it rises at Ram Ghat, takes a zigzag direction to the south-west through Salem, Revora, and Colvalle, emptying itself into the sea close to the village of Chapora. The bar at the entrance can only be crossed by small coasters. Chapora fort stands on a high bluff point, at the south side of the entrance, and its black walls may be easily discerned; the land adjacent

* The bar is reported to have silted up 2 feet.
See plan, No. 492.

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to the sea on this side is hilly, but on the north side of the river mouth it is sandy, with cocoa-nut trees.

Tirakul river, situated 7 miles north of Chapora river, has its source in the western Ghats, and flows in a south-westerly direction for 14½ miles, thence, forming the northern boundary of the territory of Goa, until nearing the river mouth.

Tirakul fort, standing on the brow of a hill, on the north side of the river entrance, is the northern limit of the Goa territory; the fort and one mile round it being all that belongs to the Portuguese on this side of the river, which has 8 or 9 feet at low water in its narrow entrance. There are two dangerous rocks westward of the river mouth, but a vessel may anchor with the fort bearing north-east, in 5 fathoms, mud, 1¼ miles off shore.

See chart, No. 740.

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CHAPTER V.

SOUTH KONKAN, AND PART OF NORTH KONKAN.—TIRAKUL RIVER TO BOMBAY.

(Lat. 15° 43′ N. to lat. 19° 0′ N.).

VARIATION, 0° 40′ E. in 1900.

The Coast northward of Tirakul river to Daman, a distance of 300 miles, named Konkan, is British territory, with the exception of the 30 miles between Bankot and Chaul belonging to Hubshi of Rajpuri, which little independent state separates North from South Konkan.

The general features of both north and south districts consist of small sandy bays and bold rocky capes. South Konkan has much table-land along the sea-board.

The Ghats, which are the eastern boundary of the Konkan, are from 3,000 to 3,500 feet above the sea, and without any remarkable peaks. They stand like a wall parallel to the coast, from which they are distant, on an average, 30 miles. That part of them named Mahabaleshwar hills is the southern limit of the North Konkan Ghats and the source of Kistna river, which flows into the bay of Bengal.

RAIRI POINT, in lat. 15° 45′ N., long. 73° 38′ E., is a flat rocky projection, the outer extreme of which is 50 feet above the sea. Foul ground extends to the westward half a mile from this point, and to the south-west as far as Rairi rock. At one mile north-east of the point there is a creek available only for small boats; on the south side of which, near the entrance, stands Rairi fort, 100 feet above the sea. About 3 miles east of the fort lies Nanasi hill, 390 feet high.

Rairi rock, 36 feet high, situated nearly one mile S.S.W. from Rairi point, is steep-to, and lies just within the 5-fathoms contour-line of soundings. At night vessels should not shoal under 10 fathoms in this vicinity.

Havelock rock, on which the *Havelock* struck in December 1872, is a sharp pinnacle, dry at low water, with 5 fathoms close around. From this rock Tirakul fort lies E. ½ N. and Rairi rock N.W. ½ N. About 4 cables N.E. by E. of Havelock rock there is a rock awash.

See chart, No. 740.

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VENGURLA (Vingorla).—The coast from Rairi point trends in a northerly direction 7 miles to Vengurla point, on which stands a house and a flagstaff; on the east side of this point there is a small bay with a creek. About midway between these points lies Machlimar point, 200 feet high, having on its south side a small creek of the same name. At 5 miles E.N.E. from Vengurla point there is a conspicuous wooded hill, 1,000 feet high named Waghghiri or Tiger hill. Vengurla town, situated about one mile east of Vengurla point, is the seaport of the Belgaum district, to which it is connected by good roads. Vengurla (1891) contains 10,334 inhabitants; it has a tolerably good bazaar, and an increasing number of merchants. Fresh water is obtainable at a spring just within the entrance of the creek.

In the bay formed by Vengurla point small native vessels find shelter from north-west winds, and at high water are enabled to discharge cargo under a crane on a stone wharf.

Trade.—The value of the **exports** in 1896–97 amounted to 1,430,482 rupees, of the **imports** to 1,892,378 rupees. In that year Vengurla was entered by 1,657 vessels of 98,978 aggregate tonnage.

LIGHTS.—At Vengurla point, two *fixed white* lights, vertical, are shown on a mast at 371 and 350 feet above high water: they are visible in clear weather from a distance of 9 miles; and are exhibited from September 1st to June 15th.

South rocks.—South rock, with 10 feet water lies 4 cables S. ¼ E. from Vengurla point; at about half a cable south-west of this rock there is a small shoal of 15 feet, and at the same distance west of it another patch with 17 feet upon it; these patches have depths of 4¾ fathoms close around. Midway between South rock and Vengurla point there is a small shoal with 15 feet water upon it and 4½ fathoms close around.

East rock, with 6 feet water upon it, and 3½ fathoms close around, lies 3 cables S.E. from Vengurla point.

South-west point rock, with 4 feet least water and 3½ fathoms close around, lies a quarter of a mile west from Vengurla point.

Anchorage may be obtained in 5½ fathoms, mud, in Vengurla roadstead, with the flagstaff bearing N.E. by N., distant about three-quarters of a mile; or nearer the shore in 5¼ fathoms, with the flagstaff on the same bearing, and the custom house in line with the pier, N.E. by E.; from whence Dabholi point will bear N. ½ W.

Storm Signals.—*See* page 56 for particulars.

Tides.—It is high water, full and change, at Vengurla, at 11 h. 13 m.; springs rise 6 ft. 9 in., neaps, 5 ft. 6 in.; neaps range 1 ft. 6 in.

See chart, No. 902, and plan on it, of Vengurla.

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Between Vengurla roads, and the northern entrance to Karil Kachal channel, during springs, the flood sets northward and the ebb southward, about one knot an hour.

Nuti point.—From Vengurla point the coast trends in a north-westerly direction, 8 miles to Nuti point, forming a bight, with several rocky capes and sandy bays. The ruins of Nuti fort stand on the point 170 feet above the sea; the land at the back rises to a height of 500 feet. At a quarter of a mile south-west from Nuti point lies a sunken rock named Bubra.

Buoy.—A black buoy is moored in 6 fathoms water, close to the south-west side of Bubra rock during the fine season.

VENGURLA ROCKS, or BURNT ISLANDS, consist of a group of islets and sunken rocks, extending 3 miles in a north and south direction, and about one mile east and west, situated 2½ miles south-west of Nuti point. The highest islet of the group, named Vengurla rock, is conical, and 140 feet above the sea. The southernmost islets bear W. by N. from Vengurla point, distant about 9 miles, on the outermost of which, 80 feet high, stands an old lighthouse building. There are two sunken rocks southward of these, with 12 fathoms close to on their south side. Tapti, the southern rock, on which the *Tapti* struck in November 1872, has 5 feet water over it, and lies with the old lighthouse bearing N.W. by N., and the summit of Vengurla rock N.N.E. ½ E.

LIGHT.—A *fixed white* light is exhibited from the north-west extreme of the south-east island (3 cables south of Vengurla rock), at an elevation of 132 feet above the sea; the light is visible between the bearings S. 15° W., through south, east and north, to N. 75° W., and should be seen in clear weather at the distance of 16 miles. The building is square, with a white tower 31 feet high.

Karil rock, the northernmost of the group, bearing W. ½ S. 2¾ miles from Nuti point, is a peaked islet, 90 feet high, and safe to approach on its north side, where there is a depth of 9 fathoms within 2 cables, but 3½ cables east of it there is a rock awash, which is the south-western danger in Karil Kachal channel.

Karil Kachal channel, between Karil rock and Chaldea rock, is about a mile wide, but between the Vengurla rocks and Nuti point it is double that width, with depths of 6 to 9 fathoms. Approaching this channel from northward, bring Tiger hill well open to the southward of Nuti point; the latter bearing E. ¼ S., leads in the fairway north of Karil rock, and when all the Burnt islands and rocks bear westward of South, alter course gradually to the south-east to avoid Bubra rock, thence steer for Vengurla point.

See plan, Malwan to Vengurla, including the Kachal channel, No. 902.

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At night vessels should not use the Karil Kachal channel. When passing the Vengurla rocks, they should not shoal under from 17 to 20 fathoms.

Anchorage.—These rocks afford good protection from north-west winds, during which anchorage may be obtained to leeward of them in 11 to 12 fathoms, mud.

Karli river mouth, on the sandy shore 2 miles N.N.W. from Nuti point, is only available for small boats, with a native pilot; off it are several islets, and a great extent of dangerous foul ground projecting $2\frac{1}{2}$ miles from the coast, which should not be approached under 11 fathoms water.

Chaldea rock, awash at low-water springs, lies near the south end of Karli foul ground, on the north side of Karil Kachal channel; from it Nuti point bears E. by S. $\frac{1}{2}$ S., distant $2\frac{1}{2}$ miles, and the centre of Karil islet S. by W. $\frac{1}{2}$ W. There is a small patch of 4 fathoms, $2\frac{1}{2}$ cables southward of Chaldea rock.

Buoy.—A red buoy is moored about 2 cables south-west of Chaldea rock.

Square rock, 40 feet high, the western visible danger of the Karli group of islets and rocks, bears N.W. $\frac{1}{4}$ W. $4\frac{1}{4}$ miles from Nuti point, and $3\frac{1}{3}$ miles N. $\frac{3}{4}$ W. from Karil rock.

Mandel rock, 18 feet high, at $2\frac{1}{4}$ miles N. $\frac{1}{2}$ E. from Square rock, stands on the western edge of a cluster of shoals, three quarters of a mile in extent; the soundings are irregular with occasional depths of $4\frac{3}{4}$ fathoms for one mile westward of Mandel rock.

Malwan rock, with 8 feet water, and 9 fathoms close outside it lies W. by N. $1\frac{6}{10}$ miles from Mandel rock. From its centre, Square rock bears S.S.E. $\frac{1}{4}$ E., and the south extreme of Sindhudrug island E. by N. $\frac{3}{4}$ N. Square rock in line with Nuti point leads 8 cables south-westward of Malwan rock.

Buoy.—A red buoy is moored on the west side of Malwan rock.

By night.—When passing Malwan rock at night, Vengurla rocks light should not be brought to bear southward of S.S.E., nor should a vessel approach it within a depth of 15 fathoms.

Malwan.—The coast from Nuti point trends in a northerly direction 7 miles to Sindhudrug, a low fortified island about half a mile long north and south, and a quarter of a mile across. Between this island and fort Rajkot, at half a mile north of it, lies Malwan bay, in which small native vessels find a snug but limited anchorage in 12 to 16 feet water.

Light boat—Buoys.—On the north side of the fairway leading into Malwan bay there are three black buoys, and about midway between

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See chart, No. 902, and plan on it, of Malwan bay.

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the two outer of these buoys there is a rock on which stands a perch surmounted by a red cage. On the south side of the fairway, about a cable south-eastward of the perch, there is also a black buoy. A short distance south-east of the perch a light boat is moored in 16 feet water.

LIGHTS.—A *fixed green* light is shown from a white mast on the beach at an elevation of 20 feet above high water, and a *fixed red* light from the boat south-eastward of the perch, at an elevation of 28 feet above the sea; the *green* light is visible in clear weather from a distance of 2 miles, and the *red* light 4 miles.

The *green* light seen just south of the *red* light, bearing E. by N. ½ N., leads into the anchorage in Malwan bay.

The town of Malwan stands on the northern shore of the bay, on low ground and is almost hidden by cocoa-nut trees. It contains a sub-judge's court and a post office. A ruined fort stands on a projecting point on the south side of the bay, eastward of Sindhudrug island. Iron-ore of good quality has been found in this neighbourhood.

Johnston Castle rock, with 6 feet least water, and 4 to 5 fathoms, close-to, lies W. by S., 4 cables from the north end of Sindhudrug island.

Buoy.—A buoy painted red is moored in 8 fathoms water, one cable westward of the rock.

Between Malwan and the south extreme of Vengurla rocks, excepting in Karil Kachal channel, the bottom is sand and rock, with sudden overfalls. The smallest vessel should not shoal under 10 fathoms off the foul ground of Sindhudrug and Karli.

Anchorage may be obtained in 8 fathoms, mud, off Malwan bay, with Kura islet bearing North, and the north end of Sindhudrug island East.

Tides.—It is high water, full and change, at Malwan at 10 h. 1 m.; springs rise 7½ feet, neaps rise 6 feet.

The coast from Malwan bay trends in a northerly direction half a mile, thence it recedes and forms a bay named Chiwallyachi Bandar, one mile across north and south, and half a mile deep. During southerly winds landing may be effected on the south shore of this bay near the collector's kutcherry; but, with north-west winds, the landing is better in Malwan bay. A native boat will pilot in.

At about half a mile north of Chiwallyachi Bandar lies the entrance to Sarjekot river, which is only available for small boats. Kura islet, 40 feet high, is the largest of a cluster of rocks situated 1¼ miles north-west of the river entrance and three-quarters of a mile from the shore, with depths of 4 to 5 fathoms in the channel between.

See chart, No. 902, and plan on it, of Malwan bay.

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At the back of Malwan and Sarjekot there is a range of hills from 400 to 600 feet high; the northern peak lies 5 miles north-east from Kura, and is well-defined.

ACHRA RIVER, situated 5½ miles north of Kura islet, is only accessible to small boats; on the north-west side of the entrance there is a cape about 180 feet high. The coast between Sarjekot and Achra rivers is all sandy, with cocoa-nut trees; sandy bottom extends one to 2 miles from the shore.

The coast from Achra river to Deogarh harbour at 12 miles north of it, thence to Viziadrug 11¼ miles farther north, is comparatively regular, though it contains numerous small rivers and creeks. The cliffs are steep and abrupt, with sandy beaches and coves in some parts. Above the cliffs the land is flat, and farther back rise hills of bare laterite rock, with little or no vegetation save in the rainy season. At about 20 miles inland are the Western Ghats, which have an average height of 3,000 feet.

DEOGARH HARBOUR is formed by a flat rocky peninsular nearly one mile long and about 140 feet high, on the south side of Deogarh river entrance. This peninsular appears at times like an island, but the south end of it is connected with the main land by a narrow sandy neck, on the north side of which stands Deogarh town. On the north end of the peninsular, and overlooking the harbour, there is an old fort built of large blocks of laterite. The passage into this harbour is not a quarter of a mile wide, and the ground is foul for a considerable distance from the north entrance point.

Deogarh is the headquarters of the sub-division of the same name, and has a population (1891) of 1,400. The town is in charge of a Mámlatdár, and there is a subordinate judge's court, post office, custom house, and vernacular school.

Exports.—The principal exports are hemp, betel, sugar-cane, wood-fuel, bamboos, and fish; the total value for the year 1891–92 amounted to Rs. 121,337.

Imports.—The principal imports are rice, grain, oil, cocoa-nuts, salt, and piece goods; the total value for the year 1891–92 amounted to Rs. 100,845.

Supplies.—Water is good and abundant, but other supplies are scarce.

Communication.—In the fine season two of Shepherd and Co.'s steam vessels call at Deogarh every morning on the passage to and from Bombay: they are fast modern vessels, but only carry passengers and

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See chart, No. 739, and plan of Deogarh harbour, No. 59.

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light deck cargoes. From the 1st June to 15th September these vessels do not run.

There is a good cart road over the Phonda pass to Kolhapur and the interior. Bullock carts and doolies are the only means of conveyance. There is no telegraph, but telegrams can be sent by post to the nearest station, north or south.

Climate.—Deogarh is considered by the native officials as feverish and unhealthy. In the winter months the climate is temperate and the nights cool. Snakes are very plentiful, especially the small poisonous *Echis carinata.*

Tides.—In the months of November and December, it is high water, full and change, in Deogarh harbour at 10 h. 13 m., springs rise 8 feet 2 inches, neaps 6 feet 9 inches. There is scarcely any stream of tide at the anchorage in the harbour, but during springs the ebb tide runs from one to 1½ knots in the narrow channels. Outside the harbour the tidal streams are irregular, both in strength and direction, being greatly influenced by the wind, but on several occasions the flood stream was observed to set to the N.W. and the ebb to the S.S.W., greatest strength 1½ knots.

Directions.—Vessels proceeding into Deogarh harbour should bring the summit of saddle hill to bear E. ¼ N. and steer in on that bearing until past the fort, thence steer to the south-east and anchor in 2½ fathoms water, with Fort point bearing West, and Green point South. Vessels drawing less than 12 feet may anchor farther to the southward where the water is generally smooth.

Caution.—Care is necessary when proceeding into Deogarh harbour, to avoid the rocks which extend from the north entrance point.

VIZIADRUG HARBOUR, in lat. 16° 33′ N., long. 73° 19′ E., extends 1½ miles north and south and 1¼ miles east and west, with depths of 3½ to 6 fathoms. On the south shore of the harbour there are several projecting points, Parweka point the southernmost is low and rocky; at about 1⅓ miles east of this point stands Ghari wadda old flag-staff, which is now difficult to distinguish from seaward. Burmana point from which a reef extends about a quarter of a mile, is the south entrance point of the harbour, and lies one mile north-north-east from Parweka. At 8½ cables east-north-east of Burmana point stands Viziadrug fort on a projecting rocky point which forms the west side of Viziadrug river entrance. The upper level of the fort is 100 feet above the sea; the land to the southward, being higher, obscures the fort from vessels in that direction. There are good wells in the fort.

See plan, Rajapur bay and Viziadrug harbour, No. 57.

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A good road leads from Viziadrug to Vaghotan, and into the Deccan, but it is little used. The village of Viziadrug is small, and the inhabitants are principally engaged in fishing.

Viziadrug river is navigable at high-water as far as Vaghotan by vessels drawing 7 feet. At a distance of 2 miles from the fort, on the west side of the river, there is an old filled up dock, that used to take vessels of 500 tons. At Vaghotan there is a stone jetty at which native craft load and discharge. Canoes can reach Kariputtan, 20 miles from the entrance.

Navigable depths.—Between Viziadrug fort point and the cliffs with a ruined battery north-eastward, the depth is $3\frac{1}{2}$ fathoms at low water, within this the water shoals rapidly to 2 fathoms; but during the south-west monsoon the depths here in the day time are 2 to 3 feet greater.

The deep channel of the river, in which there is $2\frac{1}{4}$ fathoms at the entrance, and $4\frac{3}{4}$ fathoms $1\frac{1}{2}$ miles farther in, lies close to the western shore.

Anchorage.—In the fine season, vessels may anchor anywhere in the harbour, but the most convenient is in $3\frac{3}{4}$ fathoms mud and clay, with the north extreme of the fort bearing about S.W. by W. $\frac{1}{2}$ W. Vessels drawing less than 12 feet may enter the river and lie in smooth water off the landing place, one cable from the shore. A long vessel should be moored head and stern, with the best bower to the ebb, which in the freshets runs at the rate of nearly 4 knots an hour.

This river affords good shelter during the south-west monsoon.

Tides.—It is high-water, full and change, at Viziadrug at 10 h. 16 m.; mean springs rise 6 feet 9 inches, neaps 4 feet 10 inches.

From March to September, springs rise, a.m. 8 ft. 4 ins.; p.m. 7 ft. 5 ins.
„ „ neaps „ „ 4 „ 11 „ ; „ 6 „ 3 „
From September to March, springs „ „ 7 „ 5 „ ; „ 8 „ 4 „
„ „ neaps „ „ 6 „ 3 „ ; „ 4 „ 11 „

In March and September the a.m. and p.m. high waters at spring tides attain nearly the same level. With the sun's declination south, the a.m. low-water of spring tides is generally four feet above the datum; with the sun's declination north, the p.m. low-water of spring tides is similarly affected. At extraordinary springs the water falls from one foot to 1 ft. 6 in. below the datum.

ANGRIA BANK, situated 65 miles west of Viziadrug and 4 miles outside the 100-fathoms contour-line of soundings, and composed of sand, shells, and coral, is 22 miles long north and south, and 11 miles across its broadest part. The least water found on this bank in the year 1847 was 11 fathoms, the general depths, however, are 12 to 15 fathoms. To the

See plan, No. 57.

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eastward of it there are soundings of 120 to 200 fathoms, with no bottom close around on the outside.

Tides.—It is high-water, full and change, on Angria Bank, at 10 h. 30 m., springs rise 9 feet. Across the bank the flood sets north-east and the ebb south-west.

RAJAPUR BAY.—The coast between Viziadrug and Rajapur bays trends in a northerly direction 1½ miles, and consists of cliffs about 70 feet high, faced by large masses of laterite. It is deeply indented in many places, and there are no dangers beyond a quarter of a mile from the shore. Rajapur bay is about three-quarters of a mile wide at its entrance and one mile deep, with depths of 5 to 4 fathoms, decreasing gradually towards the head of the bay; it affords shelter from north-westers, which blow during the fine season, but with westerly winds there is a heavy short swell in the bay, when the anchorage is not safe. Tulsunda cove, on the south side of the bay, is accessible to small vessels when overtaken by a south-west gale.

Rajapur or Jaitapur river enters the north-east part of the bay, and at 15 miles from its mouth is the town of Rajapur, a place of considerable importance; coasting vessels, however, cannot proceed up so far. On the north side of the river, at a short distance within the entrance, stands the old fortress of Yashwantgarh, now in ruin and overrun by trees and jungle.

In a sandy cove on the north side of the bay there is a well of good water, whence native craft obtain supply. On the ridge, west of the well, there is a stone octagonal tower 103 feet above the sea.

Navigable depths.—There is a depth of 7 or 8 feet on the bar at low-water, and further in abreast the large village of Jaitapur, which is situated on the left bank of the river, from 15 to 24 feet.

LIGHT.—A *fixed white* light is shown from a white tower, 21 feet high, standing near the edge of the cliff on Wagapur (Jaitapur) point, at the south side of the entrance of Rajapur bay. The light is elevated 75 feet above high water, and should be visible from a distance of 9 miles in clear weather from the bearing of S. 30° W. through South and East to N. 15° W.

Holi or Three-tree hill, a round sloping mount, 285 feet high, 1¾ miles E. by S. ½ S. from Musargagi, or Rajapur north point, is a conspicuous feature near Rajapur bay, as the table-land of the Konkan faced with steep cliffs, everywhere presents almost the same appearance and affords no salient landmark.

See plan, Rajapur bay and Viziadrug harbour, No. 57.

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Ambolgarh bay, immediately north of Rajapur bay, is one mile wide between Musargagi point and Ambolgarh point on the north side of the entrance, and nearly one mile deep. Across the entrance there are depths of 5¼ fathoms, decreasing gradually to 3 fathoms within 2 cables of the sandy beach at the head of the bay. The land at the back of this beach consists of low flat ridges of laterite, on the south side of which there is a valley, and the remains of extensive salt works. On the north side of the bay, just within Ambolgarh point, stands the village of Ambolgarh.

Ambolgarh reef, on which the sea breaks heavily, lies on the northern side of the entrance to Ambolgarh bay; it is nearly half a mile in extent east and west, and a quarter of a mile across the broadest part, with general depths of one to 2½ fathoms upon it, and 5 fathoms around. Near the centre of the reef several rocks uncover at low-water, from which the tower on Musargagi point bears S.E. by E. ¼ E., and Ambolgarh point N.N.E. ½ E.

Buoy.—A black buoy is moored during the north-east monsoon, in 7 fathoms, 1½ cables from the south-west edge of the reef, and 4 cables from the part which dries.

Tides.—It is high-water, full and change, in Rajapur bay, at 10 h. 45 m.; ordinary springs rise 6 feet 6 inches, neaps 4 feet 6 inches; neaps range 2 feet 6 inches.*

The coast from Ambolgarh point trends in a northerly direction about 19 miles to Kushipur point at the south entrance of Ratnagiri bay. Between Ambolgarh point and the small town of Yetia 3 miles north of it, the coast is sandy, thence to Purangarh fort 7½ miles further north, it consists of rocky table-land. The fort is situated on the brow of a barren hill at the mouth of Muchkundi river, only available for small coasting vessels at high-water; Pent, the principal town, lies just within the entrance. Purangarh outer point is one mile north-west of the fort.

The coast between Purangarh and Paos bay at 5½ miles north of it, consists of rocky table-land and small sandy bays, with no outlying dangers. The land at the back of Purangarh, Paos, and Ratnagiri gradually rises from the sea coast in undulating hills, till at 5 or 6 miles distance it is from 600 to 700 feet above the sea; it has no remarkable features. Hurchiri, a round wooded hill 890 feet high, 8 miles E.N.E. from Paos bay, is conspicuous at the back of the above land.

PAOS BAY is a snug and deep cove affording sheltered anchorage during north-westers in 4 or 5 fathoms, mud and sand. The town

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* *See* remarks on tides at page 175.

See plan, No. 57, and chart, No. 739.

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of Paos is about 3 miles from the entrance of a small creek at the head of the bay.

RATNAGIRI BAY, lying 4 miles northward of Paos bay, is 2 miles wide north and south, and one mile deep, with general soundings of 4 to 6 fathoms, bottom sand and mud. From Kushipur point, shoal water extends in a northerly direction for 6 cables, near the middle of which stands Brum Mudle, a detached rock above water, upon which the sea breaks heavily during the south-west monsoon. The shore from Kushipur point to Kurli point, at three-quarters of a mile to the north-east, is composed of steep laterite rock; thence for a mile northward to the entrance of Ratnagiri river the shore is a low sandy flat, faced by a beach upon which there is a heavy surf during the south-west monsoon. From the mouth of the river to the old Mahratta fort standing on the north entrance point of the bay the shore is low and fringed with cocoa-nut palms.

The fort covers a bold and conspicuous headland of laterite of about half a mile in extent, which is connected to the mainland by a sandy neck, and being from 200 to 300 feet in height, and having perpendicular cliffs, it appears from a distance to be insulated.

Ratnagiri river and town.—Ratnagiri river extends about 30 miles inland, but is shallow, and navigable only by small native craft at high water. The European station at the north side of the river entrance is on the brow of a flat ridge about 150 feet above the sea, where there is a court-house, collector's kutcherry, hospital, and post office. In January and February large numbers of canoes are engaged in sardine fishing.

During the fine season, vessels of the British India Steam Navigation Company call weekly, and there is also daily communication with the coast ports by other small steam-vessels. In the south-west monsoon the mail steam-vessels land passengers and goods at Kalbadavie bay, from which there is a good road to Ratnagiri.

Imports.—The chief imports are salt, timber, catechu, and grain.

Exports.—The exports consist of fuel, fish, and bamboos.

The landing-place in Ratnagiri bay during the north-east monsoon is at the custom-house, about half a mile from the fort, but a good look-out must be kept, as extensive reefs project from the shore and isolated patches of rock covered with kelp and seaweed, and nearly awash at low water, lie scattered about upon which the sea does not always break. During westerly breezes, which sometimes set in during the fine season, and occasionally last for three days, a heavy swell rolls up, and landing here becomes hazardous; on such occasions Kilaka bandar, on the north side of

See plan, Ratnagiri, Mirya and Kalbadavie bays, No. 56.

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the headland may be used. In the south-west monsoon there is a very heavy surf in Ratnagiri bay, and landing is then generally impracticable.

LIGHT.—A *fixed white* light is shown at 320 feet above high water, from a white tower, 35 feet high, in the south bastion of the old fort on Ratnagiri headland, which is visible in clear weather from a distance of 15 miles when bearing from N. 17° W., through east to S. 3° W.

Position.—Lat. 16° 59′ N., long. 73° 16′ E.

Storm signals.—A short distance south of the lighthouse there is a storm signal station; for particulars of signals *see* page 56.

Anchorage.—Sailing vessels should anchor in the outer roadstead in 7 fathoms, mud, with the lighthouse bearing N.E. by E. and Kushipur point S.E. Steam vessels at the beginning or close of the south-west monsoon should anchor in 6 fathoms, with the lighthouse bearing north and the saw-mill chimney E.N.E., but during the fair season they may go into $5\frac{1}{4}$ fathoms with the lighthouse bearing N.W. and the custom-house N.E.

Ratnagiri bay affords no shelter during the south-west monsoon, at which season smooth water anchorage can be obtained in Kalbadavie bay (*see* page 180).

Tides.*—It is high water, full and change, at Ratnagiri, at 10 h. 40 m.; mean springs rise $6\frac{1}{4}$ feet, neaps $4\frac{1}{2}$ feet.

It is said that, when the south-west monsoon is in full force, there is 4 feet more water at low tide, in the daytime, in all the bays along this part of the coast, than there is during the fine season.

MIRYA DONGHUR is a high headland of bare laterite rock, lighter in colour than the adjacent land, and appears like an island when seen from northward or southward; its sea face terminates in steep cliffs. The highest part, Mirya peak, half a mile from the south-west point of the headland, is 465 feet above the sea, and has an old flagstaff on its summit.

Mirya bay is formed between Miyet point, the south-west point of Mirya Donghur, and Ratnagiri headland; it is $1\frac{1}{2}$ miles wide and one mile deep, with soundings of 4 to 6 fathoms.

The shore at the head of Mirya bay is covered with cocoa-nut palms and fronted by a ridge of sand-hills from 20 to 30 feet above high water. At the back there is an extensive flat of mud and sand, overgrown with mangroves, and covered at high water springs; through this flat Sirgaum creek winds up to the native portion of the town of Ratnagiri.

Native coasters, when overtaken by a southerly gale during the fine season, anchor under the headland at the south side of Mirya bay.

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* *See* remarks on tides at page 175.
See plan, No. 56.

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The northern part of the bay affords shelter for small vessels from north-westers, in 3 or 4 fathoms, mud and sand; care, however, is necessary to avoid Mudle shoal, and the rocky patches lying off the cliffs. There is no anchorage in this bay during the south-west monsoon, as a heavy sea then rolls in and breaks in 2 to 3 fathoms water.

Mudle or Taylor shoal, on which the sea breaks heavily at low water, lies with its shoalest part of 5 feet S.E. ½ E. 7 cables from Miyet point; it is two cables long east and west, and one cable across.

Kalbadavie bay.—The sea-face of Mirya Donghur headland is nearly 2 miles long, and on its north side lies Kalbadavie bay, in the south-east corner of which sheltered anchorage may be obtained during south-west winds, in 5 fathoms, mud, 3 cables from the rocky cliffs on the north-east side of the headland.

The mail steamers call here to land passengers and goods for Ratnagiri in the south-west monsoon.

The entrance to Sirgaum creek is on the north-east side of Mirya Donghur, where it joins Kalbadavie river, which extends some distance inland, and on the north side of the entrance to this river stands the village and temples of Kalbadavie. Large native craft proceed up Sirgaum creek at high water, and lie off a bandar near Ratnagiri, where they load or discharge their cargoes.

About 1½ miles north-west of Mirya Donghur headland there is a patch of 5¼ fathoms, rock and coral, with 8 fathoms around it.

The coast from Kalbadavie bay trends in a northerly direction 4 miles to Neori point, which projects nearly three-quarters of a mile from the line of coast. Warori bluff, at 5 miles further north, projects about one mile in a north-westerly direction, forming a small bay; on the north side of the bluff there is sheltered anchorage in 3 fathoms, sand and mud, during the south-west monsoon. The entrance to a small river lies at the head of the bay, on the bar of which there are depths of 6 or 7 feet at high water. Between Warori bluff and Ambwah bay, at 4 miles north of it, the shore is composed of sandy bays and rocky points. Ambwah bay affords shelter from north-west winds in 4 fathoms, sand and mud, with the west point of the bay bearing W.N.W.

JAIGARH.—Kardeshwar (Jaigarh) point, the north-west extreme of Jaigarh headland, lies 2 miles north of Ambwah point, and from seaward appears to be a level and almost barren plateau, terminating in steep cliffs faced with laterite rocks; on the steep face of the cliffs stands an ancient Hindu temple.

See plan of Kalbadavie bay, No. 56.

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LIGHTS.—From an iron structure, 32 feet high, on the north-west point of Jaigarh headland, is exhibited, at an elevation of 134 feet above high water, a *fixed white* light, visible 13 miles in clear weather from seaward between the bearings of north and south.

A *fixed red* light is also shown from the northern bastion of Jaigarth fort.

Position.—Latitude, 17° 18′ N; longitude, 73° 11′ E.

Shastri or Sangameswar river enters the sea to the northward of Jaigarh headland, and its estuary forms a well-sheltered convenient harbour, tolerably easy of access, even during the south-west monsoon. The river is tidal as far as Sangameshwar, an important native town about 28 miles from its mouth; and at 18 miles E.S.E. from its entrance it receives the waters of three tributaries, the Bao, the Gurni, and another stream. The Shastri river is shallow, but clear of obstructions.

The southern shore of the estuary from Kardeshwar point trends in an easterly direction 2 miles to the west entrance point of Shastri river, on which stands an old Mahratta fortress, in which are several wells of good water, and a few habitable dwellings. (A *fixed red* light is shown from the northern bastion of this fort.) The village of Jaigarh, a straggling line of houses along the shore southward of the fort, is principally inhabited by fishermen; the custom-house is at the landing-place.

Anchorage.—The best anchorage is in 4½ fathoms in Damankul bay with the extreme north point of Jaigarh headland bearing W. by S., distant 4 cables, or for vessels of lesser draught in 3½ fathoms with the point W. by N. distant 5 cables.

The northern shore of the estuary trends from the east entrance point of the river in a northerly direction 1¼ miles, thence north-westerly 1½ miles, and is composed of bare hills with steep cliffy sides, and small sandy bays at the mouths of the valleys which separate the ridges. The general height of these coast hills varies between 200 and 300 feet. A single tree on the highest of these hills, bearing N. by E. ½ E. from Jaigarh fort, is conspicuous from seaward.

The northern entrance point of the river is a sandy spit planted with cocoa-nut trees, from which Mora sands, dry at low water springs, extend across to within 1¾ cables of Jaigarh fort. Eastward of the spit, the northern bank of the river with its steep hill slopes, trends in an easterly direction.

The bar extends in a N.N.E. and S.S.W. direction across the estuary, westward of the fort. The shoalest part of the bar, named Bar sand, is 6 cables in extent north and south, and 2 cables across, with depths of 7 to 12 feet, and 13 to 16 feet close around.

See plan of Jaigarh and entrance to Shastri river, No. 247.

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Navigable depths.—The channel between Bar sand and the south shore is about one cable wide, having in the middle a depth of about 15 feet at low water, and 23 feet at high water springs; 17 feet at low water, and 22 feet at high water neaps. The channel north of the sand is more than two cables in width, but has one foot less water.

Katane reef, situated three-quarters of a mile north of Bar sand is small and uncovers at low water spring tides, with depths of 24 and 25 feet close around. The outer edge of this reef is 2½ cables from the point off which it lies.

Supplies at Jaigarh are limited to fish and poultry, the latter being difficult to obtain; water can be procured from two wells near the landing-place.

Communication.—There is daily communication during the fine season by small steamers between Jaigarh and Bombay; and also with the ports southward as far as Goa.

Tides.—It is high water, full and change, at Jaigarh, at 10 h. 16 m.

From March to September,	springs	rise,	a.m.	9	ft.	8	ins.;	p.m.	8	ft.	0 ins.
„	„	neaps	„	6	„	6	„;	„	7	„	11 „
From September to March,	springs	„	„	8	„	0	„;	„	9	„	8 „
„	„	neaps	„	7	„	11	„;	„	6	„	6 „

Directions.—Entering Shastri river from southward, Kardeshwar point should not be approached within 3 cables, as several rocky shoals lie off the north-west shore of Jaigarh headland. When the lighthouse bears south and Jaigarh fort point E. by S. ¾ S., steer for it on that bearing and avoid passing within 1½ cables of the east point of Damankul bay. Thence the conspicuous tree on the high land above the cocoa nut trees bearing E. ¾ S. will lead midway between Bar sand and the shore, at about three-quarters of a cable from the latter, which distance must be preserved in rounding the fort point, to avoid Mora sandbanks. Boria headland shut in with the fort bluff, clears the west edge of the sand.

The conspicuous tree bearing S.E. by E. ¼ E. will lead through the middle of the northern channel, until the fort point bears S. by E. ½ E. when it may be steered for.

Anchorage.—In the river the best anchorage is about 2 cables from the south shore, in 5 fathoms at low water, with the extreme of the fort point bearing N.N.W. ¾ W., and the conspicuous tree over the sandy point N.E. ¼ E.

Caution.—South-westward of this anchorage there is a deep bight, at the outer part of which the water shoals suddenly from 4 fathoms to 10 feet.

See plan of Jaigarh and entrance to Shastri river, No. 247.

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Eastward of the anchorage the south shore is shallow, and is fronted by Kurli sand, a long narrow bank of sand and mud, which dries at low water spring tides.

From the anchorage, the channel, of over 18 feet, runs in an east-north-east direction towards the low sandy point, covered with palms, on the north side of the river, and continues thence, close to that shore, varying between a half cable and 1½ cables in width. The south side of the channel shoals rapidly towards Kurli sand.

Boria point, situated 6¼ miles north of Jaigarh head, is a high bluff headland, about 1½ miles long north-west and south-east, the top of the ridge forming several summits close together, on the highest of which is situated a small Hindu temple, commonly called Boria pagoda, 360 feet above the sea. In Boria bay on the south side of the headland small vessels may obtain shelter in 4 to 5 fathoms, mud, with the south extreme of the headland bearing about W.N.W. The shore between Jaigarh and Boria headland is composed of small sandy bays divided by rocky points.

The coast between Boria headland and Ranwee point at 9 miles north of it recedes and forms a bay about 2 miles deep; at 2 miles north-eastward of Boria pagoda lies the small bay of Palshet. The shore northward of Palshet is a long sandy beach, near which is situated the large village of Guhagar.

WASHISHTI (Dabhol) RIVER is a considerable stream which enters the sea about 18 miles northward of Jaigarh. Though narrow, it is deep and clear of obstructions within the bar. Chiplun, the principal town on the Washishti, is about 28 miles from its mouth. The land on both sides of the entrance to the river is high and undulating, with here and there steep slopes and cliffs to the water's edge.

Tolkeshwar point is a bold bluff, faced with cliffs 300 feet high, on the south side of the entrance to the Washishti; on its summit is an ancient Hindu temple. On the rocky ledge extending from the cliffs of Tolkeshwar point there is a conspicuous pinnacle rock 20 feet high, having close to it rocks which cover at high water. On a prominent point, about three-quarters of a mile eastward of Tolkeshwar temple, there is an old Mahratta fortress in ruins.

LIGHTS.—On Tolkeshwar point, from an iron column 28 feet high painted white (enclosed at its base by a circular iron house), is exhibited at 333 feet above high water, a *fixed white* light, which should be visible seaward in clear weather between the bearings of N. 15° W. and S. 17° E., for a distance of 15 miles.

See chart, No. 738, and plan on it, of port Dabhol.

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On the northernmost point of the old fort (Anjanwel) is exhibited at 36 feet above high water a *fixed green* light, which should be seen in clear weather from a distance of 5 miles.

These lights are shown from 16th September to 15th June.

Anjanwel bay, at the head of which stands the town of Anjanwel, lies just east of the old fortress; it is shallow, and at the anchorage for native craft, off the custom-house, there is at times a heavy sea. On the south shore of the river, for a distance of 4 miles eastward of Anjanwel, there are some small shallow bays between high bluff points, which dry at low water.

Yeldur rock, with 17 feet water, lies nearly 2 cables from the southern shore, abreast Yeldur village, about one mile east of Anjanwel fort.

Dabhol is a small straggling town situated at the foot of the hills on the northern point of entrance to the Washishti. There is a small wharf, and a floating stage here alongside which the coasting steamers can lie. Near this landing-place stands a large and handsome mosque. Formerly Dabhol was noted for its velvet and silk manufactures, and there are still a few weavers of common silk materials.

Light.—On the west end of the wharf, at 24 feet above high water, is exhibited, between 16th September and 15th June, a *fixed red* light, which should be visible in clear weather from a distance of 4 miles.

Supplies are difficult to obtain in any quantity, though fish is fairly plentiful. The water is not very good.

Tides.—It is high water, full and change, at Dabhol, at 10 h. 40 m. Mean springs rise 8 feet; neap rise 5½ feet.

Pir Balu, a conical hill, 821 feet high, having on its summit a dome-shaped tomb, is situated 2 miles eastward of Dabhol. It forms an excellent landmark as its sharp summit may be distinguished above the flat ridges of laterite rock in this locality.

Churpulti sand is a narrow spit extending 1½ miles in a W. by S. ½ S. direction from the north entrance point of Washishti river.

A buoy is moored on the west extreme of this sand.

The channel between Churpulti sand and the cliffs near Anjanwel fort is only 1½ cables wide. The bar is a mile outside the fort, and at low water spring tides has depths of 11 feet on its shallowest ridge, which curves round seaward from Churpulti sand, and approaches to within 2 cables of Pinnacle rock.

Navigable depths.—In the channel over the bar between the south end of the shallow ridge and Tolkeshwar point there are depths of

See enlarged plan of port Dabhol, on chart, No. 738.

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about 13 feet at low water, and 21 feet at high water springs; 15 feet at low water, and 19 feet at high water neaps.

Directions.—Approaching the river, do not shoal under 5 fathoms until Tolkeshwar bluff bears East, then steer for it on that bearing, and when a cable from Pinnacle rock, steer along the steep South shore preserving that distance up to Anjawel fort. The water deepens rapidly after crossing the bar. Pass the point next eastward of the fort at about $1\frac{1}{4}$ cables, as rocks extend from it for half that distance, and anchor one to 2 cables off Dabhol jetty in 5 fathoms, mud.

The COAST from port Dabhol to Bankot, at 25 miles north of it, consists of a series of plateaux, varying in height from 200 to 600 feet, having here and there a remarkable peak. Occasionally there is a narrow strip of land between the plateau and the sea, but generally the descent is abrupt to the high water margin. Trees are scarce, and the jungle consists of sparse bushes. Between Dabhol and Bankot there are no dangers beyond the 5-fathoms contour-line of soundings, which extends $1\frac{1}{2}$ to 3 miles from the coast.

Burundi.—Midway between Anjanwel and Herni, a small town 15 miles north of it, lies Burundi bay which affords shelter from southerly winds to small vessels.

Herni.—The land projects about half a mile at Herni and forms a small bay which affords shelter for boats only, from north-west winds. The shore of the bay is fringed with rocks.

Southwest of Herni point, and close to it, there is a small island, from which sunken rocks extend 3 cables to the westward. A vessel communicating with Herni, may anchor in $3\frac{3}{4}$ fathoms, with this island bearing N.E. distant about one mile.

Savaradrug, a low fortified island, about half a mile west of Herni fort, is covered with jungle, and lying under a range of hills is not easily seen from seaward. There are rocks between Savaradrug and the small island off Herni point. At $1\frac{1}{2}$ miles northward of Savaradrug lies the entrance to Jog river. At $5\frac{1}{3}$ miles N.N.W. $\frac{3}{4}$ W. of Savaradrug and one mile from the shore, lies a rock awash at low water, on a rocky flat, with $2\frac{3}{4}$ fathoms half a mile north-west from it.

SAVITRI (Mhar) RIVER generally known as port Bankot enters the sea in lat. 17° 58′ N., long. 73° 0′ E. It is a narrow stream, and with the exception of its dangerous bar is free from natural obstruction; but there are numerous fishing stakes abreast and above the town, which greatly impede the navigation.

See chart, No. 738.

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The banks of the river are steep, and the slopes are bare of vegetation, except near the fort along the south shore, where they are thickly covered with large mango and oondini trees.

The entrance to the river may be recognised by a small dark conical hill 325 feet high, named Harihareshwar, projecting into the sea on the northern side of the bay, and also by the high walls of fort Victoria (in ruins), situated on the summit of a barren plateau of laterite rock, 467 feet high, on the southern side of the river. There is an English cemetery just under the walls of the fort, in which stands a high monumental pillar visible from outside the bar.

From fort Victoria the hill slopes gradually to Panbruj point, close to which stands a fort, having on its north-west angle a white obelisk.

Outer anchorage.—A vessel may anchor in 4 to 5 fathoms outside the bar of Bankot, but entrance to the river should not be attempted without a pilot.

Navigable depths.—The bar bears W. by S. $\frac{3}{4}$ S., distant $1\frac{3}{4}$ miles from fort Victoria, and has a least depth of 7 feet at low water and 16 feet at high water, ordinary spring tides; 9 feet at low water and 14 feet at high water neap tides.

For vessels drawing 10 feet, the river is navigable at high water to Dasgaum, at the foot of the Mahad Ghats, vessels drawing less than 9 feet can proceed to Mahad, upwards of 36 miles from the entrance.

Buoys.—The channel is marked by two buoys, painted black and white, which should be left on the port hand when entering the river. The outer buoy is moored in $3\frac{1}{2}$ fathoms westward of the bar, the inner buoy is moored in 3 fathoms, with the beacon on Rankuran point bearing E. $\frac{1}{4}$ S., distant 5 cables.

A buoy, painted red, is moored one cable N.E. by N. from Bankot jetty.

Leading marks.—The white obelisk on Panbruj fort and a white obelisk on the slope of a hill on the north bank, 2 miles above Panbruj point, in line bearing N.E. by E. $\frac{1}{4}$ E., leads over the deepest part of the bar in 9 feet at low water.

After crossing the bar, the channel deepens, from $2\frac{1}{2}$ fathoms to 6 fathoms when abreast Panbruj fort; but at the anchorage opposite the custom house at the town of Bankot, the depth again decreases to 3 fathoms.

Caution is requisite in crossing the bar, as during westerly breezes which sometimes set in strong in the fine season, there are heavy breakers over it, and, except in the calmest weather, there is always a cross sea.

See plan, Bankot and entrance to Mhar or Savitri river, No. 436.

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Boats should never attempt to enter the river over the sand spit which extends south-westward of Base point.

Town.—The native town of Bankot, situated on the south side of the river, above Panbruj fort extends some distance along the shore. There is a small stone jetty near the centre of the town for landing or discharging cargo; the custom-house is at the west end of the town. Bankot contains a mixed population of Hindus and Mussulmans, which in 1879 numbered 3,770.

Supplies.—Fish is plentiful, but other supplies must be obtained from Oapoli, a village situated about 14 miles to the southward of Bankot.

Communication.—During the fine season, coasting steamers call at Bankot every alternate day; there is also a small river steamer for passengers proceeding up the river to Dasgaum.

Tides.—It is high water, full and change, at port Bankot at 10 h. 37 m.; springs rise 9 feet 7 inches; neaps rise 7 feet 3 inches; neaps range 1 foot 7 inches.

Shriwardhan bay lies 2½ miles northward of Devgad point. During the fine season coasting steam vessels call here, where supplies can be obtained better than at Bankot.

Kumbaru bay.—The coast from Devgad point, at the north entrance of port Bankot, trends in a northerly direction 9 miles to Kumbaru bay, which is about 5 miles wide north and south and 1½ miles deep, with soundings of 4 fathoms across the entrance, decreasing to 2½ fathoms about one mile from the beach. Kumbaru point, at the north end of the bay, is high, steep-to, and projects a mile in a south-westerly direction from the coast line; on the south side of this point shelter will be found for small vessels from north-west winds; the hills at the back of the point are over 800 feet high and thickly wooded.

Shah Jehan shoal, with 2¼ fathoms upon it, lies one mile south-westward of Kumbaru point, and half a mile outside of it there are places with a depth of 3¼ fathoms. Vessels when navigating in the vicinity of this point should not shoal into less than 6 fathoms.

The coast from Kumbaru point extends in a northerly direction 4 miles to Rajpuri point, at the south entrance of Janjira harbour. Between these points the shore is rocky, and fringed with foul ground, which in some parts extends nearly half a mile from the coast. At 3¼ miles N. by W. ¾ W., of Kumbaru point, and 1¼ miles from the nearest shore, lies Whale reef, awash at high water.

See chart, No. 738.

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JANJIRA HARBOUR, situated at the mouth of Rajpuri river, extends 3 miles in a south-easterly direction, having an average breadth of three-quarters of a mile within the anchoring depths, and with general depths of 3½ fathoms, decreasing to 2 fathoms at its head; thence the river is very shallow and navigable only by boats. This harbour affords good shelter from all winds except those from N.W. to W. by N.

The southern shore is formed by a peninsula, with hills 600 to 800 feet high. Rajpuri point, the north extreme of this peninsula, is a cliffy, wooded bluff, from which the shore curves gradually round to the south-east, and is comparatively steep-to outside the points for a distance of 1¾ miles: thence it recedes to the southward and forms a large bight, filled by a mud flat which dries at low water; the shores of the bight are fringed by mangroves, and on the west side of the entrance lies the village of Dighi.

The land in the vicinity of Janjira harbour is hilly and fairly well wooded, with high ranges at the back of the coast hills.

LIGHT.—Near the extreme of Rajpuri point, from a white tower 34 feet high, at an elevation of 179 feet above high water, is exhibited an *occulting* white light, eclipsed *five seconds* in every *quarter-minute*, which in clear weather should be seen from a distance of 18 miles.

Position.—Latitude 18° 17′ N.; longitude 72° 56′ E.

Whale reef, awash at high water, and nearly 2 cables in extent, lies W.S.W., 1¼ miles from the lighthouse on Rajpuri point; from this reef, shoal water, with depths under 3 fathoms, extends half a mile in a westerly and 4 cables in a southerly direction.

Buoy.—A red buoy is moored on the north side of Whale reef with Rajpuri lighthouse bearing E. by N. ½ N.

Yeoor point, on the northern side of the entrance to the harbour, is low and rocky, and the coast just northward presents the appearance of a low bluff.

A reef fringes the north-eastern side of the harbour, and extends 4 cables off shore; at 1½ miles south-east from Yeoor point lies a steep bluff, on the top of which there is a flagstaff in front of a large bungalow (the residence of H.H. the Nawab of Janjira); half a mile south of this bluff is the state jail, surrounded by a high white wall, conspicuous in the afternoon.

Marad, the principal town in the Janjira State, with a population of 5,000 or 6,000, is situated in a large grove of palms on the northern side of a small creek, which affords shelter for the country craft trading to Marad and for the local fishing boats. On the southern side of the creek

See plan of Janjira harbour, No. 400.

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the coast forms a small rounded headland, rising in the middle to a smooth grassy hill, 231 feet high, on the southern side of which is a small stone pier used by the passengers of the coasting steamers in the fine season (October to May).

Supplies.—Goats, sheep, eggs, fruit, vegetables, beef, and fish in limited quantities may be procured at Marad. Water also may be obtained, but not of good quality.

Kansa fort stands on a low flat rock $1\frac{7}{10}$ miles S.S.E. from Yeoor point; the walls are about 20 feet high, and partly in ruins.

Janjira fort is built on a rocky island off the village of Rajpuri, at 2 cables from the shore, and nearly joined to it by a reef; the walls, about 40 or 50 feet high, are in fairly good repair, and the space inside is entirely taken up by houses; on the summit of the island there is a large tree. At the back of Rajpuri village there is a smooth grassy hill.

Directions.—A vessel drawing not more than 18 feet of water, bound into Janjira harbour, should not shoal into less than 6 fathoms until Janjira fort is distinguished; when, having brought the fort to bear East, steer for it, until the lighthouse on Rajpuri point bears South, then steer E.S.E. for the anchorage in $3\frac{1}{4}$ fathoms at low water springs, with the tree on the top of Janjira fort bearing North, and Rajpuri point, about W. by S. Or, anchor about three-quarters of a mile further up the harbour, in $3\frac{3}{4}$ fathoms and better shelter, with the tree on Janjira fort N.N.W. $\frac{3}{4}$ W., and the extreme of Sandy point E. $\frac{1}{2}$ S.

Fishing stakes, consisting of large poles and sometimes of palm trees stripped of their leaves, are generally placed in certain positions within the harbour; as a rule they show well above high water.

Tides.—It is high water, full and change, in Janjira harbour, at 10 h. 47 m., springs rise 14 feet, neaps 8 to 10 feet; the range of tide at neaps is about 4 feet; the highest tide occurs from one to two days after full and change of moon.

At two miles northward of Yeoor point there is a sandy bight, on the shore of which stands the village of Nandgaon.

KUNDALIKA RIVER enters the sea about 16 miles north of Rajpuri. It is a tolerably broad stream, and the tide flows over a considerable part of the low-lying land on either side at high water springs. At its entrance are the old Portuguese forts of Korlai on the south side, and Rewadanda on the north.

At Borlai, 2 miles south of Korlai fort, there is a large fishing village, with a short creek having a bar, over which pattimars drawing 9 feet cross at high water springs during the fine season, but they more commonly anchor outside on good holding ground.

See plan of Janjira harbour, No. 400; also chart, No. 738.

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Soundings.—Westward of Borlai village and Korlai fort, the depths are not greater than 2 fathoms at nearly 2 miles off shore, from which the 3-fathoms contour-line is distant 2½ miles.

PORT CHAUL lies at the mouth of Kundalika river; the town of Chaul being outside the walls of the 16th century Portuguese fortress at the north entrance point. The tower of the Franciscan convent, 100 feet high, is conspicuous above the fort walls, within which are a few poor houses, and heaps of ruined buildings.

A sandy spit, which dries at low water spring tides, extends three-quarters of a mile westward from Rewadanda fort.

Beacon.—On the beach, 9 cables N.N.W. of the tower of the Franciscan convent, is placed a small pole beacon, surmounted by a ball, painted white.

Communication is held daily, during the fine season, with Bombay and the coast ports, by means of the small steam vessels of the Bombay Steam Navigation Company.

Population in 1891 amounted to 5,745.

Supplies.—With the exception of fish, supplies of any kind are difficult to obtain at Chaul. The water from the wells under the palm trees is slightly brackish, but good water may be procured at Salas, 2 miles up the river.

Korlai fort stands on the summit of a headland of a red colour, which appears like an island from seaward, being connected with the mainland by a low, narrow, sandy isthmus; on the north it has a gradual slope, and terminates in a rocky point. Within the fort there is a fine cistern, roofed in, containing a large quantity of pure water.

The village of Korlai is situated in a small bay eastward of the headland.

On the south side of the Kundalika, at 1¾ miles from the entrance, there is a range of wooded hills, culminating in a round summit, 834 feet in height, known as "Chaul knob."

Reefs and detached patches of rock extend from 2 cables to half a mile off the coast southward of Korlai point.

About 1½ miles to the north-east of Chaul is the temple of Hingladevi, from its peculiar whiteness forming a conspicuous object from seaward; and on the summit of the hill over the temple stands the hermitage of Datatrayamuni, also noticeable from seaward.

Six-feet patch, situated nearly 2 miles N.W. by W. ¾ W. from the north point of Korlai, is composed of sand and rock, 3½ cables long

See plan of port Chaul on chart, No. 738.

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north and south and 1½ cables across, with 6 feet least water, and 14 feet close westward of it.

Nine-feet patch, a rocky patch, with 9 feet over it at low water, lies 6 cables N.N.W. from Six-feet patch.

Chaul bar.—The entrance to Kundalika river is obstructed by a bar, having 7 feet least water over it in the channel at low water spring tides, one mile outside Korlai point.

Bar sand, lying southward of the channel over the bar, and composed of sand and rock, is 4 cables long by 1⅛ cables broad. Its shoalest part, with 3 feet water, lies one mile W.N.W. from the north point of Korlai headland.

Directions.—Vessels drawing more than 8 feet should only attempt to enter towards high water. Approaching from the northward, between Chaul Kadu beacon and the shore, steer for the centre of Korlai headland on a S.E. ¼ S. bearing, and on nearing the bar keep Chaul knob open eastward of Korlai point S.E. by E., and steer for it on that bearing. This course will lead over the bar in 8 feet at low water, midway between Bar sand and a six-feet patch extending from the north shore. Within the bar the water quickly deepens to 4 and 4¾ fathoms. Steer to pass at about 1½ cables from the rocky ledge on the east side of Korlai point; this will clear the sandy spit extending from Rewadanda fort, the edge of which is generally marked by tide-rip. On the south side of the river there is usually a line of fishing stakes, which may be passed close to their north extreme; thence anchor, as convenient, off the landing-place on the sandy point east of Rewadanda fort.

Small vessels drawing less than 9 feet, approaching from the southward may pass between Bar sand and Korlai point, by keeping the pole and ball beacon north of Rewadanda in line with the Mohammedan tomb (421 feet high), marked by a group of palm trees bearing N.E.

Tides.—It is high water, full and change, at Port Chaul, at 11 h. 0 m.; springs rise (mean) 11¼ feet, neaps rise 8 feet, neaps range 3¾ feet.

From March to Sept., springs rise, a.m. 12 ft. 4 ins.; p.m. 10 ft. 0 ins.
„ „ neaps „ „ 7 „ 4 „ ; „ 8 „ 11 „
From Sept. to March, springs „ „ 10 „ 0 „ ; „ 12 „ 4 „
„ „ neaps „ „ 8 „ 11 „ ; „ 7 „ 4 „

Fishing stakes.—Off Chaul the fishing stakes are very numerous, lying out during the fine season in 8 fathoms at low water, about 7 or 8 miles from the shore.

ALIBAGH.—From Chaul the shore trends in a northerly direction 6 miles to Alibagh creek, and is composed of a sandy beach, bordered in

See plan of port Chaul on chart, No. 738.

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some parts by groves of palm trees, which near Alibagh are interspersed with forest trees and jungle. This beach has several small creeks which dry at low water. Paulo creek, situated 2 miles north of Rewadanda fort, will admit of pattimars, at high water, proceeding to the fishing village of Therounda at half a mile within the entrance. At the entrance of Alibagh creek there is an ancient fortress, known as Kolaba, situated on an extensive reef, that is covered at high water spring tides. Within the walls there is a well-built tank containing good water, and the pagoda shaped cupola of a temple, that is conspicuous from seaward. The reef on which Kolaba fort is situated lies 3½ cables from the coast, to which it is joined at low water.

Alibagh is built on a sandy point on the north side of the creek, amidst groves of palm trees where there is a small European station. At low water a small stream winds past Alibagh, through the sandy bed, but at high water the creek presents the appearance of an extensive sheet of water, and during the rainy season is the outlet of the water which inundates the low land at the foot of the Sagargarh range.

Small vessels drawing less than 9 feet water may, on a rising tide, anchor off the entrance of the creek, tolerably close to the south edge of the reef on which the fort stands. The south patch of rocks is generally marked by a stake. There is a depth of 12 feet at low water springs, with this stake in line with Undari island, and the life boat house at Alibagh in line with Parhur peak.

LIGHT.—On Kolaba fort a *fixed green* light is exhibited at an elevation of 32 feet above high water, visible in clear weather from N. 22° W. through north to N. 67° E. from a distance of 3 miles.

This light is for the use of fishing boats and coasting craft making for Alibagh road. Any vessel not bound for Alibagh, sighting this light is in danger, and should stand off shore at once, or anchor and await daylight.

Lifeboat.—A lifeboat is stationed at Alibagh.

Storm signal.—There is a storm signal station at Alibagh; for details of signals, *see* page 56.

The shore flat, on which lie all the dangers from Chaul to about [illegible] to 4 miles from the beach, and has on its outer edge 2½ to 3 fathoms water, decreasing gradually towards the land.

CHAUL KADU REEFS, situated 4¾ miles north-westward of Korlai point and 3½ miles from the shore, consist of several rocky patches 1¼ miles in extent, north and south. The northern patch dries 9 feet at low water springs, and has on it a circular stone beacon, 20 feet in

See chart, No. 738.

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diameter and 60 feet in height, with a refuge chamber, to which there is access by an iron ladder. The beacon may be passed only on the north-east and east sides at one cable distance.

The south-west reef, with 8 feet water, on which the sea breaks heavily, lies 7 cables south-west from the beacon. Shoaler water may exist on this reef, as the vicinity has not been thoroughly examined.

ALIBAGH OUTER REEF, with 6 feet water, lies a little over 2 miles north of Chaul Kadu beacon, and 1½ miles W. by S. from Kolaba fort.

Buoy.—During the fine season a buoy painted red is moored in 15 feet water, 2½ cables south-west of this reef.

Light.—A *red* ray of light is shown from Kundari island lighthouse over Chaul Kadu and Alibagh Outer reef. (*See* page 191.)

THE COAST from Alibagh trends in a northerly direction 3½ miles to Thal, and consists of a low ridge of sandhills, behind which are dense groves of palm trees.

Warsole is a large creek, 1½ miles north of Alibagh, near the village of Warsole; boats can enter this creek at high water. The whole of this coast is fringed with reefs extending in some parts as far as 1¾ miles from the shore. The inner reefs, which lie in narrow ridges parallel to the beach (the general direction of all the reefs in this locality), are joined by low stone walls and are used as fish traps.

Eastward of Thal, at about 2½ miles from the coast, there are three high bare conspicuous peaks known as the Hummocks of Thal; the southern, a sharp conical-shaped peak, named Parhur, is 1,050 feet above the sea. Southward of Parhur the coast range trends about S.E. by S., forming in peaks of varied height. Eastward of Alibagh, a spur from the main range approaches to within 2 miles of the town, and forms in two narrow rocky ridges, 3 miles eastward of which there is a round summit named Sagargarh, faced to the southward, with conspicuous cliffs of considerable height; immediately south of the cliffs is a rocky peak, which from its shape has been named Needle peak. Southward from Sagargarh the range, continuing in the same direction, is of less elevation, and thickly covered with jungle.

Northward of Parhur, at the distance of 2½ miles, lies Kankeshwar, 1,255 feet high. This high ground is separated by a valley from a range of thickly wooded hills which extends along the south-east shore of Bombay harbour.

KUNDARI (Kenery) ISLAND, situated 11¼ miles N.N.W.¾W. from Korlai fort, 2½ miles from the shore, and 6 miles south of the

See chart, No. 738.

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entrance to Bombay harbour, is about one-quarter of a mile in extent, with two hills, on the southern and higher of which stands the lighthouse with a flagstaff north-east of it. The remains of a wall surround the island, which is sparsely covered with trees and scrub. There is excellent water on the island, and a good-landing-place in a small bight on its north-east side, especially useful during the south-west monsoon.

LIGHT.—The lighthouse on Kundari island is an octagonal stone tower, on the centre of a flat-roofed building, and exhibits, at an elevation of 153 feet above high water, a *fixed white* light, except when bearing from North to N. 25° W. when the light shows *red*. The light is visible in clear weather from a distance of 19 miles.

Position.—Latitude 18° 42′ N., longitude 72° 49′ E.

Reefs.—At 3½ cables N.N.E. from the lighthouse on Kundari island there is a rock which only covers at high water springs, having 9 to 13 feet close around it.

At 4 cables N.E. by E. ½ E. from the lighthouse lies a reef, awash at low water springs, with depths of 5 to 10 feet close around. The water is generally smooth around this reef, on which there is a beacon 31 feet high, painted black.

Telegraph.—A telegraph cable connects Kundari island with the telegraph line on the adjacent coast, and vessels are prohibited from anchoring in this vicinity between the following limits:

On the north, by a line between the north extreme of Kundari island, and the rock at 3½ cables N.N.E. of it, thence in the direction of the south brow of Kankeshwar hill.

On the south, by a line between the south extremes of Kundari and Undari islands, thence to the South-port limit boundary mark on the main land abreast.

Distant Signals.—The following distant signals are shown to vessels from Kundari island:—

You are standing into danger - - -	Ball over pendant; and two guns, fired with an interval of five seconds between them.
Annul signal - - - - - -	Two balls placed vertically; two guns with an interval of five seconds, and a third gun one minute afterwards.
Stop, something important to communicate. -	Pendant, over a ball, above a square flag.

See chart, No. 737, and plan of Bombay harbour, No. 2,621.

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Also, that the following distant signal may be made by vessels :—

Aground, want assistance - - - Square flag over a ball; one gun, and after an interval of one minute, two guns with an interval of five seconds between them.

Storm signals are repeated on the flagstaff if discernible from Kolaba signal station. For particulars *see* page 56.

A lifeboat and crew are stationed at Kundari island by the Port Trust of Bombay during the south-west monsoon.

Undari (Henery) Island, lying 1½ miles E. ½ N. from Kundari island, and one mile from the shore, is a low, dark, rocky islet, surrounded by fortifications in ruins. Within the fort, the entrance to which is on the east side, there are several large tanks and a few trees; one large banyan tree being conspicuous from seaward. A reef of rocks lies 2 cables west of the island, and the ground is rocky and uneven, for half a mile in that direction. Rocks, which dry at low water, extend 3½ cables southward, and nearly join the reefs off the mainland; the channel between Kundari and Undari island should only be used by small vessels having a local knowledge.

DIRECTION BANK, situated 30 miles south-westward of Kundari island, is about 20 miles long N.N.W. and S.S.E., and 7 miles across, with soundings of 22 to 28 fathoms, coarse sand and small shells, deepening suddenly to 30 and 32 fathoms, mud, on its eastern side, thence the depths decrease gradually towards the shore.

In approaching and crossing over this bank from westward, a vessel will pass over 30 or 40 miles to the Fifty-fathoms flat, then gradually shoal to 40 fathoms, and suddenly to 30 and 23 fathoms on Direction bank; after which the water deepens again to over 30 fathoms between the greater part of the bank and Kundari island, and to about 27 fathoms inshore of the south end of the bank.

When steering for Bombay harbour from the south-west, if the vessel be southward of the latitude of Direction bank, the water will shoal rapidly from 40 to 30 fathoms, and continue between 30 and 20 fathoms for some distance, until the latter depth is obtained about 17 miles from the land.

If northward of Direction bank, a vessel will have to run a considerable distance before changing the depth of water from 40 to 30 fathoms, but will then rapidly shoal to 20 fathoms, which depth is about 15 miles westward of Kundari island or the Outer light-vessel.

Fifty-Fathoms flat, situated 20 miles westward of Direction bank, and between the same parallels of latitude, extends further west over a

See charts, Nos. 2,736 and 737.

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space of 50 miles, with soundings of 48 to 50 fathoms, fine sand, although occasional casts of muddy bottom are found in the space which connects the two banks. But to the south-west of Direction bank the bottom is more uneven, having overfalls from 50 to 55 fathoms, and occasional casts of mud as well as sand.

On the parallel of Kundari, when within 80 miles of that island, the soundings are 50 fathoms, and decrease very regularly in steering to the eastward; but in about the meridian of 71° E. and 100 miles west of Kundari, there are shoal patches of 38 and 43 fathoms amongst the general soundings of 50 fathoms.

THE COAST, from abreast Undari island trends in a northerly direction 6 miles to the south entrance point of Bombay harbour, and is fronted by numerous rocks above and below water, named Thal reefs, some of which extend 1½ miles from the shore. Great Karanja hill, in line with the north end of Kansa island, clears the north extreme of Thal reefs.

THAL SHOAL, situated 6 miles north of Kundari island, and nearly 3 miles from the shore, is separated from Thal reefs by the East Channel swatch, which is half a mile wide with depths of 4 to 5½ fathoms. This shoal, composed of sand and rock, is nearly 2 miles long N.N.E. and S.S.W., and 6 cables across, with depths of 2½ to 4 fathoms. From its shoalest part Kundari lighthouse bears S. ¼ W., and Thal Knob beacon E. ½ S. A shoal with 15 feet water lies on the east side of East Channel swatch with Thal beacon bearing E. ½ N. 2½ miles.

Little Karanja hill, bearing N.E. ⅓ N., leads through East Channel swatch in not less than 5 fathoms water, but Kundari lighthouse must be kept to the eastward of S. by E., until Little Karanja hill is on the above bearing. When False Knob is in line with Paps beacon, a vessel may steer N. ½ E., with Cross island seen open east of Middle ground, for the anchorage. Another mark is the large tree on the east end of Butcher island and Trombay ruin in line; this is the best mark for proceeding through East Channel swatch when leaving the harbour.

Malabar point open westward of Prongs lighthouse, N. ¾ W., leads westward of Thal shoal.

BOMBAY, in lat. 18° 54′ N., long. 72° 49′ E., is the principal seaport of Western India. The city stands on Bombay island, which is connected by railway embankments on the north, with the larger island of Salsette, and so continuously with the mainland. Bombay island consists of a low lying plain about 11 miles north and south, and 3 miles across in its widest part, flanked by two parallel ridges of low hills. Kolaba, the low point at the end of the eastern ridge, protects the southern part of the harbour. The western ridge terminates in Malabar hill, 180 feet high, and between

See plan of Bombay harbour, No. 2,621.

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these hills lies Back bay, at the head of which, on slightly elevated ground, stands the Fort, now chiefly occupied by commercial offices.

The city of Bombay consists generally of well built houses and broad streets. The most conspicuous public buildings stand on the Esplanade facing Back bay, and consist of the Record Office Secretariat, University Senate Hall, High Court, Public Works Secretariat, and Post and Telegraph offices. The Sailors' Home is close to the Government Dockyard. The most conspicuous buildings in the densely built tract known as the Fort, are the Town Hall, Mint, Cathedral, Port Trust Offices, and the European General Hospital; while immediately to the north are the Victoria Railway Station and the Municipal Buildings, the tower of which is 250 feet high. There are also several native hospitals.

The northern portion of Kolaba contains the Sassoon dock (now rarely used except for landing and embarking troops and stores), factories, cotton presses, and various other commercial and industrial buildings.

On the south end of Kolaba stand the observatory, barracks, look-out tower, a lunatic asylumn, and two batteries.

Population in 1891 amounted to 821,764.

BOMBAY HARBOUR is about 15 miles long N.N.E. and S.S.W., and 4 to 6 miles wide, with general depths of 4 to 6 fathoms, the bottom generally consisting of mud. The harbour contains several islands, rocks, and shoals, and its shores are indented by numerous bays and inlets.

Port limits.—The South Port limit extends from Kundari island to the mainland abreast; West Port limit from Kundari island to the Outer light-vessel, and thence to Malabar point; North Port limit from Hog island to Trombay village, and from the south-west point of Trombay island to Sewree fort; and the East Port limit from Nocar point across the entrance of Amba river to the south extreme of Karanja island.

OUTER LIGHT VESSEL, moored in $6\frac{1}{2}$ fathoms at 7 miles N. by W. $\frac{1}{2}$ W. from Kundari island, and $3\frac{1}{2}$ miles S. by W. $\frac{1}{2}$ W. from Prongs lighthouse, exhibits at an elevation of 36 feet, a *revolving red* light, which attains its greatest brilliancy *every twenty seconds*, and should be seen in clear weather from a distance of 10 miles. The vessel is painted red, has three masts, carries a red ball at the main, and hoists a red flag in the daytime when a vessel is in sight. During the night from 1st June to 30th September, a *blue* light is burnt every half hour. From 1st October to 31st May, a *blue* light is burnt every hour, and a torch every half hour.

From the light-vessel, Sunk rock lighthouse bears N. 35° E., distant 5 miles; the shoalest part of Thal shoal E. by S. $\frac{1}{2}$ S. distant $2\frac{1}{10}$ miles, and the southern extreme of the foul ground of the South-west Prong N. by E., distant $2\frac{3}{4}$ miles.

See plan of the Port of Bombay, No. 655.

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The flood stream near the Outer light-vessel runs to the E.N.E. and the ebb to S.W., the latter making about noon at full and change, when the average rise and fall at springs is about 15 feet, and at neaps 9 feet.

EASTERN SHORE.—At three quarters of a mile eastward of the south entrance point of the harbour, and 2 cables from the shore, there is a hill 183 feet high, named Thal Knob, having on its summit a white beacon 60 feet high; about half a mile south of this hill there is a similar hill of rather less elevation named False Knob. In thick weather these hills stand out well among the cocoa-nut trees, being detached from the more distant high land.

At 3½ miles S.E. by E. ¼ E. of Thal Knob lies Ashuerra hill, 922 feet high, having on it two hummocks named the Paps, on the northern of which stands a black beacon 80 feet high.

Fishing stakes.—An extensive group of fishing stakes lie north and east of Thal shoal in 5¼ fathoms at low water springs; these stakes are removed during the south-west monsoon, but care is necessary to keep clear of their position, which is about half-way between Thal shoal and the buoy moored westward of Karanja shoal. Frequently the stakes are broken short off, and cannot be seen above water; the line of bearing of this group is about N.W. and S.E.

Kansa (Gull) islet, 20 feet high, lies at the entrance of Pen river, at $2\frac{1}{10}$ miles N.N.E. from Thal Knob beacon, and W. by N. ½ N. from the boundary pillar at Nocar point, at the south entrance of Amba river. About one cable south-west of this islet there is a knoll with 6 feet water, on which the sea breaks, and at 2 cables S.S.E. of the islet a detached rock, dry at low water.

Great Karanja is a long flat-topped hill, 991 feet high, situated on the south end of Karanja island, and bearing N.E. ¼ N. from Thal Knob beacon; the south side of this hill is steep and almost inaccessible, but the northern part slopes gradually from its summit to a peak 720 feet high, having on it a ruin.

Little Karanja hill, with a very sharp summit 696 feet high, is on the north end of Karanja island, and is formed by four ridges meeting in the centre.

Karanja reefs extend 2 miles from the west side of Karanja island, and about 4 miles north and south; the parts of this reef which dry at low water extend but a short distance from the shore, and are composed of trap rock, covered with loose boulders, and intersected with fishing ponds. On the north-west extreme of Karanja reefs, in 6 feet water, stands a red beacon 40 feet above low water springs.

See plan of Bombay harbour, No. 2,621.

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Buoys.—A red buoy surmounted by a globe is moored in 5½ fathoms off the west extreme, and a red buoy with triangle, in 7 fathoms near the north-west extreme of these reefs.

About 1½ miles N.E. ½ E. from Karanja beacon there is a shoal with 2 feet water named Uran, marked by a circular stone beacon painted red.

WESTERN SHORE.—Kolaba, the north entrance point of Bombay harbour, is a long, low, rocky point, surrounded by fringing reefs, which dry at low water for a considerable distance seaward. The south extremity of these reefs, named the Prongs, lies 1½ miles from the shore.

Kolaba, formerly separate, is now part of Bombay island, being joined to it by a substantial causeway, the space on the north side of which (between the two large blocks of houses on Arthur bandar, called Grant's buildings, and the cooperage at the south end of the esplanade) is filled in by natural and artificial agencies. That part of Kolaba in the vicinity of the look-out tower is termed Upper Kolaba, the other part Lower Kolaba. A continuous line of houses, barracks and factories connects the look-out point with the Fort of Bombay. The head of Arthur bandar, is the north-east point of Kolaba, Jamsetji bandar being situated 2 cables south-west of it, nearly abreast the Dolphin light, and the Sassoon dock 3 cables further to the south-west.

The principal channel leading into the harbour lies between Prongs reef and Thal shoal, and is about 2½ miles wide.

North Pap and Thal Knob beacons in line bearing S.E. by E. ¼ E., leads clear of all foul ground south of Prongs reef.

LIGHT.—On Prongs reef stands a lighthouse 146 feet high, from which, at an elevation of 136 feet above high water, is exhibited a *flashing white* light, showing a *flash* every *ten seconds*, visible in clear weather from a distance of 18 miles. The lighthouse is a circular tower painted with white, red, white, and black horizontal bands, and is connected by telegraph with Bombay.

Kolaba shoals extend from abreast Prongs reef, along the east side of Kolaba for a distance of about 3 miles, and project in some parts nearly a mile from the shore. On the outer edge of these shoals, abreast the south extreme of Kolaba, is a 5-feet knoll with depths of 8 to 13 feet close around.

Sunk rock.—At 5½ cables east of the 5-feet knoll there is a shoal 4 cables long, N.N.E. and S.S.W., and one cable across the broadest part, with depths of 3 to 18 feet upon it, and deeper water close around. On the northern part of this shoal lies Sunk rock, awash at low water, between which and the outer edge of Kolaba shoals there is a narrow channel.

See plan of Bombay harbour, No. 2,621.

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LIGHT.—Sunk rock lighthouse, built on the rock, is a black circular tower 95 feet high, from which at an elevation of 64 feet above high water, is exhibited a light, with *red* and *white* sectors, *occulting* every *five seconds*, visible in clear weather from a distance of 14 miles. The eclipses are from *one* to *two seconds*. The light shows *white* when between S. 7° W. and S. 30° W.; *red* from S. 30° W. through west, to N. 15° E.; *white* from N. 15° E. to N. 31° E.; and *red* from N. 31° E. to N. 69° E.

Dredgings from R.I.M. dockyard are being dropped between Sunk rock and Kolaba shoals, the depths in the passage are therefore unreliable.

Oyster rock and Nigger's head.—The former is situated 8 cables N.N.W. from Sunk rock, and half a mile from the shore. It is flat, about 70 feet high, about a cable long by half a cable broad, and has a battery on it. Nigger's head, a rock with one foot water on it, lies 2 cables southwest of Oyster rock. The shoal on which these rocks stand has on it depths of 2 to 6 feet, and 7 to 14 feet close around. The channel between these rocks and the Kolaba shoals has in it from 8 to 10 feet water.

Fishing stakes extend S.E. by S. from the north end of Oyster rock, nearly half a mile, in 17 to 27 feet water. Care is necessary when passing through, as the stakes are frequently broken off just below water.

Kolaba reef, situated a cable off shore, abreast the Victoria bandar, and 4 cables north of Oyster rock, is 4 cables long N.E. by N. and S.W. by S., with rocks drying from one to 3 feet for about half its length. Near its north and south extremes, in one and 6 feet respectively stand circular stone beacons, painted in black and red bands.

Dolphin, a small rocky shoal, which partly uncovers at low water, with 7 to 15 feet close around, and 4 fathoms about a cable east and north-east of it, lies N. ½ E., 1½ miles from Sunk rock lighthouse, and 2 cables east of the North Kolaba reef beacon.

LIGHT.—On Dolphin rock stands a gray tower 35 feet high, from which at an elevation of 20 feet above high water, is exhibited a *fixed white* and *green* light, visible in clear weather from a distance of 3 miles. The light shows *green* when bearing from north to west; *white* from west to S. 56° W.; and *green* from S. 56° W. to S. 34° E.

Middle ground shoal, situated N.N.E. ¼ E. 2 miles from Sunk rock, is 2 cables long north and south and one cable across, having near the centre a rocky islet about 40 feet high, on which stands a battery. On the shoal

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surrounding this islet there are depths of 10 to 18 feet, with 3½ to 5 fathoms close around.

A buoy painted with black and white horizontal stripes and surmounted by a triangle is moored in 3¾ fathoms water, near the north extreme of the shoal.

The University clock tower in line with the Scotch church N.W. ½ W. leads southward, and the clock tower bearing W. by N. ¾ N. leads northward of Middle ground shoal.

Wellington patch or Tilli rock, with 8 feet water, and 10 to 14 feet close around, lies 1½ cables east of the saluting battery. This is the northern of a series of patches with 5 to 8 feet water, connecting with the Kolaba reef.

Apollo spit or Falkland rock, with 11 feet water, and 13 to 15 feet close around, lies N.W. by W. about half a mile from Middle ground shoal, at 2 cables E.S.E. of Dockyard flagstaff.

Flagstaff shoal, with 8 feet least water, and 13 to 24 feet close around, lies N. by W. ½ W. about 6 cables from Middle ground shoal, and 4 cables from the shore.

A black buoy with flag is moored in about 23 feet water near the south-east end of flagstaff shoal.

North patch, with 11 feet water, and 13 feet close around, lies N. by W. ¼ W. nearly one mile from Middle ground, and 2 cables from South Bori bandar.

A 10-feet patch lies E. by S., three-quarters of a cable from the North patch.

A buoy with globe, painted black, is moored in 23 feet water at 3 cables E. ½ N. from North patch.

Cross island reef, with 2 feet water, and 12 to 14 feet close around, is about one cable long north and south, and a quarter of a cable across its broadest part.

A black buoy with triangle, is moored in 24 feet about 1½ cables east of Cross island reef.

Just west of the line joining the above buoy and North patch buoy the bottom is very foul, there being several rocky patches having from 7 to 12 feet water

Nearly 2 cables south-west of Cross island reef lies a shoal with 2 feet water, on which stands the South Channel beacon, 36 feet high, painted in red and black bands. There are depths of 10 and 11 feet around this shoal, and also in the channel between it and Cross island reef.

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Cross (Gibbet) island, 64 feet high, situated N. ½ E. 1¾ miles from Middle ground, stands on the east side of a reef of rocks, which dries for a distance of 1½ cables north and west of the island. Shoals extend from this island 4 cables in a south-westerly, and 2½ cables in a northerly direction. The southern shoal has depths of one to 4 feet, and on its north-west edge, in 5 feet water, stands a tripedal beacon with staff and diamond; between this shoal and the shore there is a narrow belt in which is 9 to 12 feet water. The north shoal has 3 to 6 feet water, and on its north extreme stands North Channel beacon 28 feet high, painted in black and red bands.

LIGHT.—A *fixed white* light is shown from North Channel beacon while the dock gates are open, visible from N. 40° W. through west and south to N. 69° E.

Bhandarwada hill, on which stand Belvedere house, and the Grant reservoir, is situated in Mazagon, immediately behind the P. and O. dockyard; it is 161 feet high, and is easily recognized from its isolated position, and through being surmounted by a few palms of unusual height.

Fishing stakes.—There are three groups of fishing stakes between Cross island and Mazagon; the west group lies in 7 feet water about half a mile E. by N. from Mazagon pier; the middle group in 17 to 23 feet, three-quarters of a mile E. by S. from the pier; and the east group in 17 to 19 feet, about one mile E. by N. from Cross island.

Parel hill, near which stands Government House, at 2 miles north of Mazagon, is 192 feet high, but is not conspicuous.

Sewree fort stands on a hill 199 feet high, close to the shore, and is now used as a magazine.

Trombay high land, on the north side of the upper part of Bombay harbour, has on its south extreme a small mosque named Pau pir, from which the land rises in a northerly direction to a hill 995 feet high, named Salsette. On the east shoulder of this hill, about 1½ miles from the summit, stands an old Portuguese church in ruins.

LIGHT.—From a red beacon on the custom house pier at Trombay (Tourbah), a *fixed red* light is exhibited at an elevation of 12 feet above high water, visible in clear weather from a distance of 5 miles.

Tucker patch, at 2 miles S.W. ½ W. from Butcher island, and 1¾ miles N.E. by E. from Middle ground, is marked by a beacon 42 feet high, and painted in black and red bands. Another patch, distant 2¼ cables N. by W. ½ W. from this beacon, is formed of rubble stone, the highest point of which dries 7 feet, and is marked by an iron framework, carrying

See plan of the Port of Bombay, No. 655.

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a triangle, the apex of which is 18 feet above high water. There is a shoal with 10 feet water situated one cable east of this beacon.

Butcher island, 68 feet high, situated 3 miles E. by N. ¼ N. from Cross island is nearly half a mile long, and a quarter of a mile across. It is surrounded by rocks which extend to a distance of one mile from its south-western side. The island contains barracks, storehouses, and a cemetery; at the south-east end there is a large tree. About 6 cables south of the island there is a rock with 8 feet water, and 7 to 9 fathoms a short distance east of it; this rock is marked by a black stone beacon 36 feet high.

Butcher Big reef is separated from Butcher island reef by a channel 2 cables wide, with depths of 7 to 16 feet. The Big reef is 1½ miles long N.N.E. and S.S.W., and half a mile across; the middle part dries from one to 4 feet at low water.

Buoys.—A red buoy with globe is moored in 22 feet near the west edge of this reef, and a red buoy with triangle in 16 feet near the northern limit of the shoal water off the reef.

Elephanta island, about one mile east of Butcher island, is wooded, and has on it two hills, separated by a deep ravine, the eastern 553 feet and the western, in which are the celebrated caves, about 300 feet high. There is a pier on the north-east shore, which is the best landing place on the island. There is also a pier on the north-west side of Elephanta island which is used as a landing place for the caves. The end of this pier, which only just uncovers at low water, is marked by an iron tripod with a cage painted black, 10 feet above high water.

Elephanta rock, having 6 feet at low water springs, lies 2 cables off the south end of Elephanta island.

Shewa beacon, a red masonry pillar, with a pole and ball on top, is placed on the east side of the channel between Elephanta island and Hog island. The ball stands 46 feet above low water spring tides.

Barnacle rock, on the west side of the same channel, is marked by a black pillar, 30 feet high.

Elephanta spit is a shoal spit of mud extending N.N.E., 7½ cables from the north end of the island. The end of the spit is marked by a **buoy,** coloured black and white in horizontal stripes, surmounted by a cage.

Hog island lies about three-quarters of a mile east of Elephanta island on the south side of the entrance to Panwel river.

See plan of Bombay harbour, No. 2,621.

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WET DOCKS.—Prince's dock.—The first stone of this extensive dock was laid by H.R.H. the Prince of Wales on the 11th November 1875, and the dock was opened for traffic on the 1st January 1880.

The dock has an area of 30 acres of water, it is 1,460 feet long, and 1,000 feet wide, with a jetty at the north end, 700 feet long and 240 feet wide. The length of the berthage in the dock is 5,960 feet, and along the outer wall next the harbour 1,590 feet. There are two entrances, the northern 66 feet and the southern 55 feet in width. The depth on the sills of both is 28¼ feet at high water ordinary spring tides. The bottom of the dock has been excavated 3 feet below the sills.

There are fifty-one movable hydraulic cranes for working cargo, capable of lifting 30 cwt. through a height of 60 feet; and at the head of the jetty is a crane which is capable of raising 30 tons; also, a 5-ton hydraulic capstan for warping vessels into the dock.

There are also two capstans, capable of sustaining a strain of 5 tons, and two of 11 tons, for warping vessels at the entrances. Eleven closed transit sheds, having an area of 331,260 square feet, have been erected on the wharves, besides nine wharehouses, with an area of 139,160 square feet. Fresh water is laid along the wharf, and is available from numerous hydrants for ordinary use, and in case of fire.

Victoria dock, in continuation of Prince's dock, was opened 12th March 1888. It has an area of 25 acres of water, is 1,270 feet long and 1,000 feet wide, and has three jetties on its western side, each 400 feet long and 230 feet wide. The length of berthage in the dock is 7,425 feet. The communication passage with the Prince's dock is 64 feet wide, closed by a caisson.

The sea entrance is 80 feet wide. At high water ordinary spring tides there is a depth of 30¼ feet on the sill, the bottom of the dock is 3 feet lower than the sill.

There are fifty-seven movable hydraulic cranes for working cargo, capable of lifting 30 cwt. through a height of 60 feet; in the south-east corner of the dock there is a 20-ton crane, and on the south jetty a crane capable of raising 100 tons through a height of 40 feet. Ten closed transit sheds having an area of 307,642 square feet have been erected on the wharves, besides four warehouses with an area of 129,600 square feet.

Sassoon dock, length 632 feet, width at entrance 40 feet, has a depth over sill at high water ordinary springs of 21¼ feet. The gates of the Sassoon dock are not usually closed.

Government New basin which was opened in 1894, has an area of 4¾ acres and 1,500 feet length of berthage, the longest quay being 486

See plan of the Port of Bombay, No. 655.

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feet. The width of entrance is 60 feet, and the depth of the sill at high water ordinary spring tides 23 feet. The bottom of the basin has been excavated 2 feet below the sill.

The Torpedo dock is in the south-west corner of the basin.

	Graving Docks.	Length over all.	Breadth of entrance.	Depth over sill at high water ordinary springs.
		Feet.	Feet.	Feet.
Government.	Lower Bombay	256	51 1/12	16½
	Middle „	183	51 5/6	16½
	Upper „	200¾	45¾	14½
	Lower Duncan	316½	60	24
	Upper „	302½	60	24
	New Torpedo	160	25	13½
Mercantile.	P. & O. Old (Mazagon)	154	35	5
	P. & O. Ritchie	495	66	18
	B. I. Mogul, Lower	217	60	15½
	B. I. „ Upper	196	47	15½
	Merewether (Port Trust)	538 5/6	65½	28¼
	Viegas patent slip	Cradle 232		

The Government docks are on the west side of the harbour near the Fort. The lower and middle Bombay docks can be used as one dock; the Upper Bombay dock has been roofed in, and converted into a torpedo-boat dock. The Duncan docks can be used as one dock, 626 feet on blocks, with caisson in outer groove. There is a gridiron adjacent for small vessels. When the new Torpedo dock is used by torpedo boats, the depth on blocks is only 11 feet.

The Mercantile docks are about 3½ miles north of the Fort. The Mazagon old dock is only suitable for lighters and small craft. The Mogul docks are used as one dock, and have taken a vessel 390 feet in length; there are only 14 feet at high water springs in the channel leading to them. The Merewether dock, which was opened on 3rd March 1891, is in the north-west corner of Prince's dock; the floor rises one foot from the entrance to the head.

See plan of the Port of Bombay, No. 655.

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Dimensions and draught of largest vessels docked in Bombay to April 1896:—

Prince's dock.—Length of vessel 435 feet, draught 25 feet 6 inches.

Victoria dock.—Length of vessel 465 feet, draught 27 feet 5 inches.

Bombay docks.—Length of vessel 315 feet, draught 14 feet 10 inches.

Duncan docks.—H.M.S. *Serapis*, length 380 feet, draught 18½ feet; also H.M.S. *Marathon*, draught 19¾ feet.

Ritchie dock.—Largest vessel docked, S.S. *Oceana*, length 475 feet and lightened to 18 feet draught.

Mogul dock.—This dock has taken a vessel of 4,074 tons, 390 feet long, and 42 feet beam.

Merewether dock.—Largest vessel docked, S.S. *Caledonia*, 7,558 tons, 486 feet in length, 54 feet 3 inches beam, and 23 feet 4 inches draught.

Viegas patent slip has taken a vessel of 1,200 tons, and 14 feet draught.

Repairs.—At the R.I.M. dockyard there is a factory well stocked with machinery, where engines of any size can be repaired, and cylinders cast. Large boilers, also, can be repaired or made.

The P. and O. Company, and several private firms, have extensive plant, and can execute large repairs to the hulls of ships, or to engines and boilers.

Life boat.—A life boat is kept in readiness close to the Pilot Bandar at Kolaba.

Storm signals will be displayed at the Bombay Castle flagstaff by day and night, and at the Victoria dock entrance by day only; for particulars of signals, *see* page 56.

Copies of all weather telegrams are posted at the Port office, and also at the dock master's office, Prince's dock.

TIME SIGNALS.—Prince's and Victoria docks.—A time ball is dropped by electricity from Kolaba Observatory, daily, Sundays excepted, from the clock tower of the Prince's and Victoria dock offices at noon, Bombay mean time, or 19 h. 8 m. 44·3 s. Greenwich mean time. Ball hoisted close up five minutes before signal. In case of failure of the ball to drop correctly, a flag will immediately be hoisted, and the ball will be dropped again at 2 p.m., Bombay mean time.

See plan of the Port of Bombay, No. 655.

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Bombay Castle.—A time ball is dropped by electricity from Kolaba Observatory daily, Sundays excepted, at Bombay castle at one o'clock p.m., Bombay mean time, or 20 h. 8 m. 44·3 s., Greenwich mean time. Ball hoisted close up five minutes before signal. In case of failure of the ball to drop correctly, a flag is immediately hoisted, and the ball is dropped again exactly at 2 p.m., Bombay mean time; but the time of re-dropping the ball will be altered from 2 p.m. to 3 p.m., Bombay mean time, should the ball at the docks fail to drop correctly on the same day. The clock in the time ball tower, having a centre seconds hand, beats every two seconds by means of an electrical current in unison with the clock at the observatory at Kolaba, and indicates, practically, exact Bombay mean time.

Supplies of all kinds are obtainable in Bombay.

Water.—Fresh water is supplied by the port authorities from their steam tank vessel.

Coal can be obtained in large quantities from several firms in Bombay, some of which keep in store 3,000 to 40,000 tons, and are supplied in bulk from barges.

Imports consist of coal, cotton and wool manufactures, twist and yarn, machinery, metals, kerosene, sugar, &c., and amount in value annually to 373,277,201 rupees.

Exports, consisting of coffee, raw cotton, twist, yarn, dyes, rice, hides, jute, opium, seeds, tea, wool, &c., amount to 376,170,522 rupees.

Shipping.—During the year 1897 the number of vessels that entered the port of Bombay amounted to 1,939, with an aggregate of 2,146,824 tons.

Pilots.—The direction and management of the port, pilotage, and docks, under the control of the trustees of the port are vested in the port officer. The pilot service consists of 15 licensed pilots.

The pilot schooner is a fore-and-aft rigged vessel, painted black, with a white ribbon or band, 2 inches wide, close above the covering board, and has her number in large white figures on each bow. During the day a red and white horizontal flag is hoisted at the foremast head when vessels are in sight; and at night the usual pilot signal is exhibited. During the south-west monsoon and in bad weather, the schooner cruises between Outer light-vessel, bearing S.E. 2 miles, and Kundari island, bearing S.E. 5 miles; the position between these bearings is known as the Outer station. In very heavy weather, when the vessel is compelled to leave the Outer station, she cruises between Sunk rock and the Outer light-vessel.

*See plan of Bombay harbour, No. 2,621.

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Anchorage.—The usual anchorage is on the west side of the harbour, abreast the town of Bombay; but good anchorage may be obtained in any part of the harbour. Vessels arriving without a pilot must anchor to the eastward of the Sunk rock light. The anchorage for vessels of war lies between Bombay Castle and Sunk rock, and the several moorings are marked by buoys.

All vessels should be moored, as a general rule, S.S.W. and N.N.E.; between the 1st October and the 31st May with 45 fathoms of cable each way; between the 1st June and 30th September vessels should be moored with 60 fathoms of cable on the south-south-west anchor, and 45 fathoms on the north-north-east anchor; vessels moored in the eddies off middle ground should have 75 fathoms on the south-west anchor. Vessels should be berthed in a sufficient depth of water to enable them to load to their deepest draught without touching the ground, and in a position where they will swing clear of all other vessels, fixed moorings, shoals, and buoys.

Vessels which are intended and are ready on arrival to be placed in Wet dock, but which cannot enter the dock until the next flood-tide, may be placed at single anchor off the Dock channel, or as near thereto as their draught of water will admit; and may, after receipt of an order from an officer of the department, be left by the pilot in charge of the commander; but in no other case shall a pilot quit an inward-bound vessel after once taking charge, until after the vessel is received into dock or berthed in the harbour.

Vessels intended to be placed in Wet dock, but which on arrival are of heavier draught than the depth of water at the dock entrance will admit, or from other circumstances may not be able to enter the dock within 24 hours, shall be moored or placed at single anchor in the harbour as may be ordered.

Vessels arriving with or taking in gunpowder should be anchored not nearer than one mile south-east from the Middle ground, or in stormy unsettled weather, not nearer than one mile from the easternmost shipping, with Cross island, not bearing westward of N.W.

Vessels arriving with, or taking in dynamite, nitro-glycerine, or other explosives, shall, in the absence of special orders, be anchored not nearer than one and a half miles south-eastward of the Sunk rock light.

Vessels remaining below the Middle ground over 24 hours shall be moored, unless the commander signifies in writing his readiness to take charge of the vessel, at single anchor.

A space is reserved off the Yacht club as an anchorage for Yachts, within which no vessel other than yachts and small passenger boats are permitted to pass.

See plan of the Port of Bombay, No. 655.

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Quarantine ground.—Vessels arriving in harbour, which are liable to quarantine under the regulations, or which may be ordered quarantine, shall anchor within the following limits:—Sunk rock lighthouse in transit with the Prongs lighthouse, W. by $\frac{3}{4}$ S., and the Dolphin lighthouse bearing from N.W. to W.N.W., in $5\frac{1}{4}$ to 6 fathoms at low water springs, distant from $1\frac{1}{4}$ to 2 miles from Sunk rock lighthouse.

TIDES.—It is high water, full and change, at the Apollo bandar at 11 h. 35 m.; at Outer light-vessel at 0 h. 20 m.; at Prongs lighthouse at noon; at Mazagon at 11 h. 30 m.; at North Karanja buoy, at South Karanja buoy, and all along the eastern shore at 0 h. 30 m. The tide coming out of Amba river is met at Nocar point, where it is high water, full and change, at 0 h. 25 m.

In Bombay harbour springs rise $14\frac{1}{4}$ feet, except at extraordinary springs, when the rise is as much as 18 feet; neap tides rise $11\frac{1}{4}$ feet. The velocity of strong springs between Thal shoal and the Prongs is $2\frac{1}{2}$ to 3 knots per hour, and 4 knots during the rains. In the entrance of the harbour the tide does not set fairly through the channel, but the flood stream sweeps over the extremity of the foul ground of Thal shoal eastward, towards the opening leading past Gull island to Amba river. During the rains in the south-west monsoon, the ebb sets strong out of Amba river to the westward, which greatly assists vessels in working out of the harbour.

The tides are subject to a large diurnal inequality, which may either accelerate or retard the times of high and low water, sometimes to the amount of an hour or more.

From September to March the night tides are higher than the day tides; in December and January, at springs, the difference is 2 to 3 feet. From March to September the day tides are higher than the night tides, the difference being greatest in June and July at springs.

Flood tide, Eastern shore.—At the Outer light-vessel the flood sets E.S.E. to E.N.E., taking a more northerly direction as the tide strengthens; to the westward of Thal land, N.N.E. until the mouth of the Amba river is opened, where it takes a more easterly course, and from thence along the shore of Karanja from E.N.E. to N.E. until it reaches the north Karanja buoy, where it sets more easterly or about N.E. by E. $\frac{1}{2}$ E. After rounding Butcher island beacon the flood stream sets N. by E. between Butcher island and Elephanta after passing Butcher island it sets in a north-east direction towards Trombay. Midway between Butcher island and Pau Pir (Trombay) the two streams meet, setting from North to E.N.E.

See plan of Bombay harbour, No. 2,621.

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Western shore.—Off the Prongs the first of the flood sets E.S.E., and as the tide makes stronger it sets N.E.; east of Prongs and thence to the Sunk rock, N.E. by N. From Sunk rock to Cross island, inside the Middle ground, it sets from N. by E. to N.N.E., and from a position immediately east of Cross island to abreast Mazagon, from North to N. by E.; from Mazagon to where the tides meet between Pau Pir and Butcher island, N.E. to E.N.E. From Sunk rock to Mazagon and to the eastward of the Middle ground, the flood sets N. by E. to N.N.E. until off Tucker beacon, where the tide separates and sets more easterly and more northerly withal.

From Uran beacon towards the Shewa beacon the flood tide sets N.E. by E. to E. by N., until it reaches the Barnacle beacon, east of Elephanta island, where it takes a N.N.E. course; north of Hog island it takes a more easterly course.

Ebb tide, Eastern shore.—From Hog island the tide sets S.S.W. until off the south point of Elephanta, where it turns sharp to the westward and W. by S., until the channel between Elephanta and Butcher island is opened out, where it runs S.W. ½ W., and so continues along the Karanja shore as far as the South Karanja buoy; whence it takes a S.W. course as far as the mouth of the Amba river, where it runs about W.S.W. nearing the Thal. It sets S.W. to S.S.W. and more southerly as it proceeds south; between Thal and the Outer light-vessel the ebb tide sets S.W. by W.

Western shore.—From Trombay to Mazagon the ebb tide sets from S.W. by W. to S.S.W., and from Green island towards Mazagon S.W. ½ W. From Mazagon to the eastward of Cross island the stream sets S. by W. From Cross island to the inside of Middle ground the ebb tide sets S.S.W., from thence to Sunk rock S. by W., and from the Sunk rock to the Prongs, S.W. Abreast the Prongs the ebb sets from W. by S. to W. by N. As the tide strengthens the course of the ebb stream changes from W.S.W. to S.S.W.

East of Cross island and Middle ground, in mid-channel the ebb sets from S. by W. to S.S.W., and from south of the Middle ground to Sunk rock S. by W., but at the first of the ebb the direction is here more westerly. At neap tides the set is nearly the same, but not so strong, and between Sunk rock and the light-vessel the set is more easterly, particularly in the month of September, after heavy rain. The set of the ebb at the Outer light-vessel is from East to E.S.E.

The Stream of the Ebb tide on the western shore of Bombay harbour makes down during ordinary tides 30 to 35 minutes earlier than on the eastern, and during strong spring tides from 40 minutes to one

See plan of Bombay harbour, No. 2,621.

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hour sooner, which causes a greater rise of from 4 to 6 inches on the western shore.

Inshore of Flagstaff shoal, during the south-west monsoon, the ebb stream makes about three-quarters of an hour before high water. This is important in docking vessels at the Government dockyard.

The direction of the tides at the entrance of the harbour is entirely changed by strong winds.

Fishing stakes are not allowed to be placed in the approaches to Bombay harbour within the following prescribed limits:—

Within the space bounded on the east by the western port limit; on the north by Prongs lighthouse bearing East; and on the south by Kundari island lighthouse, bearing East.

Fishing stakes are not allowed to be placed within the ranges of visibility of either Prongs or Kundari island lights, outside the 10-fathoms contour-line of soundings. North of the Prongs, and south of Kundari island light, fishing stakes are placed inside the 10-fathoms contour-line within the range of visibility of those lights. Mariners are therefore cautioned of the danger incurred should they approach within the 10-fathoms line either northward or southward of the limits, more especially as the fishermen sometimes place their stakes as far out as 11½ fathoms within those limits.

Within the port limits, the fairway to the anchorage is kept free from fishing stakes, except the line of them 2½ miles north-eastward of Thal shoal.

DIRECTIONS.—Approaching Bombay.—From March until the south-west monsoon begins, in the end of May or early in June and again (after the rainy season) in the month of October, the winds off this coast are principally north-west, veering to W.N.W. or west from the forenoon towards sunset, then north-west till midnight, and to N.N.W. or north from midnight till the forenoon.

When steering for Bombay harbour, from the middle of May till August, steady gales and clear weather will be experienced at times, until within 70 or 90 miles of the coast; but cloudy weather with rain and squalls may be expected on the bank of soundings, as the land is approached.

If not certain of the latitude it will be prudent to keep between the parallels of latitude 18° 15′ N. to 18° 25′ N., and endeavour to get soundings on Direction bank, after passing over the Fifty-fathoms flat.

During the early part and strength of the south-west monsoon, great care must be observed not to get northward of the entrance of the harbour, for then the flood tide, as well as the heave of the southerly swell, frequently set vessels along the bank towards the gulf of Cambay; and late in May, June, and July, it would be found difficult at times to work round

See plan of Bombay harbour, No. 2,621, and chart, No. 2,736.

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the South-west Prong. Therefore, in these months a course should be steered direct for Kundari island, allowing for a northerly set on the flood tide—though the prevailing current outside the depth of 30 fathoms off the harbour, after the first burst of the monsoon, is to the southward,—and endeavour to make the island bearing between East and South-east, borrowing a little either way, as circumstances require, to carry a fair wind in entering the harbour.

If the wind incline to blow in squalls from West to W.N.W., do not run too close in with the land to the southward of Kundari island, nor even approach that island too near, as there might be difficulty in weathering it with these winds, which are sometimes experienced in June and July, but are more frequent in August.

From November to February, land and sea breezes generally prevail. The land wind lasts from about 9 or 10 p.m. to shortly after daylight, and the sea breeze from 10 a.m. or noon to sunset. During the interval between the land and sea breezes in the forenoon, a heavy smoky haze frequently hangs over the land obscuring everything from view, so that great care should be exercised when approaching the land shortly after daylight in these months. This also occasionally occurs during the calm hours of the evening.

From the southward a vessel should not shoal into less than 12 or 11 fathoms between port Chaul and Kundari island, as in this vicinity large fishing stakes extend some distance from the coast. When Kundari island bears southward of East a course may be steered for the Outer light-vessel, which can be passed at a convenient distance on either side, thence a N.E. $\frac{1}{2}$ N. course will lead to the anchorage east of Sunk rock, or proceed further up the harbour to the usual mooring ground abreast the city. At night the white sector of Sunk rock light leads east of the foul ground extending from Prongs lighthouse.

If, in edging to the eastward to give a wide berth to Sunk rock shoal, a vessel gets so far over as to obtain a shoal or hard cast on the edge of Karanja shoal, haul off directly to regain the fair channel on the western side of the harbour; this shoal is not however so steep-to in this part as it is further up abreast Little Karanja hill.

With the wind at west or W. by N., it will not be prudent to make free with the eastern side of the harbour, either towards Thal shoal, or Karanja reefs. Therefore do not bring Kundari light southward of S. by E. until the vessel is northward of Thal shoal, nor to the westward of S. by W. when abreast Karanja shoal.

Turning to windward do not open Cross island east of Sunk rock until the Outer light-vessel bears W. by S. A vessel will then be north of Thal shoal, and may stand to the eastward until Thal Knob beacon is in line

See plan of Bombay harbour, No. 2,621.

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with Parhur peak bearing S. by E. ¼ E., when the depths will be 3¼ to 4 fathoms, being careful to avoid the fishing stakes 2½ miles north-east of Thal shoal. It must be borne in mind, however, that Cross island is often very difficult to recognize as it is usually surrounded by shipping.

In standing from the Prongs towards the middle of Karanja shoal, the soundings will be a good guide, as they decrease gradually. When Great Karanja south brow bears southward of East, tack on shoaling to 5 fathoms at low water, or 7 fathoms towards high water. But with Little Karanja peak bearing East or southward of East, the soundings will not be such a guide, care is therefore necessary not to approach too near the north-west extreme of the Karanja shoals. In this part the east side of the harbour is the deeper, and shoals gradually towards the Middle ground; whereas, southward of Sunk rock, the west side of the harbour is the deeper, and thence it shoals towards Karanja.

When Sunk rock bears N.W. by W. ¾ W. a vessel will be north of the red buoy with globe, abreast the southern part of Karanja reefs; thence the eastern turning mark will be Butcher island tree in line with Trombay ruin, until Middle ground bears N.W. by W. ½ W.

Generally, vessels are moored on the inner side of the Middle ground shoal, and from thence up to abreast Cross island, but when the harbour is crowded, some vessels moor further out, in the stream of that shoal, as the raising of the shoal above the level of high water to form the battery has caused the tide streams in its vicinity to run with greater velocity.

It would not be advisable for a stranger to pass within Middle ground shoal to the shipping in the night, but to anchor before Sunk rock light bears S.W. by W.; or, if necessary, further out, between Sunk rock shoal and the entrance of the harbour, where the sea is broken by the reefs. The port rules forbid any vessel, if above 200 tons, to enter, leave or be moved in the port, without having a pilot, harbour-master, or assistant to the port officer or harbour master on board.

When the wind is northerly, vessels generally work up between Karanja shoal and Middle ground shoal, then pass round the north end of the latter in proceeding to their moorings; this is more convenient with a northerly wind and flood tide.

The channel between Middle ground shoal and the north part of Karanja shoal, is about 1½ miles broad.

From the northward do not shoal into less than 12 fathoms, until Prongs lighthouse bears northward of East, when a course may be steered for the Outer light-vessel, whence proceed as directed.

Turning to windward do not open Kundari island east of the Outer light-vessel, until North Pap and Thal Knob beacons are in line bearing

See plan of Bombay harbour, No. 2,621.

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S.E. by E. ¼ E., and when Prongs lighthouse is in line with the west extreme of Malabar point, proceed as before for the anchorage.

Inshore channels.—South channel.—Vessels proceeding through the South channel, should, after passing west of the buoy east of the North patch, steer to pass the South channel beacon at a distance of a half to three-quarters of a cable, when a transit post 20 feet high, and surmounted by a ball, near the south corner of Modi bandar, in line with a similar post 39 feet high, and surmounted by a triangle, near the north corner of the bandar, will lead along the east side of the channel in 9 to 12 feet water. The ball should be kept a little open east of the triangle, as there are two 3-feet patches very close east of the line of the leading marks.

North channel.—The transit post near the north corner of Modi bandar (which forms the back transit mark for the South channel) is the front mark for the North channel, and kept in line with a third transit pole 39 feet high, and surmounted by a drum further at the back, leads through in 7 feet water and clear of the North channel beacon. All transit marks and posts are painted red.

LIGHTS.—*Fixed red* lights are exhibited by night on the posts over the marks from 1st of September to 31st of May in each year. The light on the triangle mark is in each case the higher mark. The light at the ball mark will be screened from view in the North channel, and that at the drum mark from view in the South channel.

Prince's Dock channel.—The dredging operations in this channel alter both the depth and shape of it, by bringing the scour from the passage west of Butcher's island across the north-east and south-west extremes of the bank. The leading mark for the centre of the channel is a disc on the small flagstaff on the north side of the north entrance to the dock, in line with a double disc in the background bearing W. ¾ N.

The beacon on the north end of Cross island spit is about a hundred feet south of the Prince's dock channel, the limits of which are defined by two cones on poles on the north side, and two drums on poles on the south side.

LIGHTS.—When the dock gates are open, a light is exhibited from the tower on the island between the gates, at the entrance of Prince's dock, with a *red* ray over the south side of the channel, and a *white* ray over the centre. At the same time another light is exhibited from the tower on the north side of the entrance, with a *green* ray over the north side, and a *white* ray over the centre of the channel.

See plan of the Port of Bombay, No. 655.

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Victoria dock channel.—The leading marks when eastward of the North channel beacon are the same as for the Prince's dock; after passing the beacon the leading mark is a disc on the north side of the entrance to the dock in line with the lattice work signal staff of Victoria dock.

LIGHTS.—When the dock gates are open at night, a *red* light is exhibited in the place of the above disc, and two *red* lights vertical from the signal staff.

Malet shelf, a rocky patch 4 feet above low-water springs, situated close to the foreshore about 3 cables northward of the Prince's dock entrance, has a beacon on it surmounted by an iron drum, 28½ feet above low-water springs.

Middle Ground to Hog island.—From abreast Middle ground a N.E. ½ E. course will lead in 5 to 6 fathoms, until Butcher's island beacon touches the north end of Cross island bearing west; this mark leads across the flat joining Elephanta and Karanja reef, in 15 feet at low water springs. As soon as Elephanta spit buoy is seen open eastward of Elephanta pier the course is N.N.E. until Green island (before it comes in line with Elephanta spit buoy), bears W. by N., and Shewa beacon is on with the summit of Little Karanja, when a vessel may anchor in 4½ fathoms.

Buoys.—There are three red buoys (in line) on the north side of Hog island, the northernmost of which is moored 4¼ cables N. by W. ½ W. from Hog island pier.

Directions for Working out of Bombay Harbour.—During the south-west monsoon, the spring tides are favourable for leaving Bombay harbour, as the freshets, produced by the rains, then set strongly out of Amba river, directly between Thal reef and the South-west prong, and greatly assist in working out; whereas the ebb tide is weak at neaps, and with baffling light winds occurring between the squalls, and a heavy sea rolling in, vessels are frequently prevented from getting an offing.

In working out of the harbour in June or July, or in blowing unsettled weather, keep the entrance open after the pilot leaves, by working with Prongs lighthouse whilst visible, bearing from N. by E. to N.N.E. ½ E.; the flood tide and swell will then drive a vessel, if there be little wind, towards and into the harbour, and prevent her being drifted to the northward of it, or from being necessitated to anchor outside. This latter cannot be done in the south-west monsoon, without the risk of losing the anchor, and the probability of incurring greater loss. When outside of Thal reef, the water will deepen in standing to the north-westward near

See plan of Bombay harbour, No. 2,621.

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the South-west prong, and will shoal in standing to the southward, if approaching the flat off Kundari island. That island should not be approached within 3 miles.

In June and great part of July, as the squalls come mostly from the west-south-westward, work to the southward with the ebb; the following flood will not then be felt so strongly as near the reef, and a considerable stretch may be made to seaward, if the wind will admit, taking care not to get to northward of the South-west prong, by keeping the lighthouse on it northward of N.E. by N. If bound southward, after getting into 20 or 22 fathoms water, continue to stand along the coast if the depth does not decrease, observing to make a stretch to the north-westward at times when the wind is favourable, to get into 35 or 40 fathoms, when a vessel may safely proceed southward, occasionally sounding, to be certain that the depth does not decrease.

In August it is seldom difficult to get an offing, for the squalls draw to the northward of west, and the freshets usually set strong out of the rivers, when at times a vessel may stand from the harbour direct to the southward without tacking; this has also happened in June and July, although seldom. In August it is not so dangerous to get northward of the South-west prong, although still advisable to keep the entrance of the harbour open. In this month, when bound southward, it is not necessary to obtain a great offing in the parallel of Kundari island; but, after rounding that island, stand along the coast, if the wind permit, to increase the depth of water; otherwise a tack at times must be made until it is increased to 30 or 35 fathoms.

BOMBAY HARBOUR CREEKS AND RIVERS.—DHARAMTAR CREEK, at the head of which is Amba river, extends from Kansa (Gull) islet eastward for $3\frac{1}{2}$ miles; at the entrance the depths are three fathoms, shoaling to $2\frac{1}{2}$ fathoms south of Karanja village, where there are fishing stakes; from here the water shoals gradually to the mud banks which line the shore. On the south-east side is the entrance of the Amba river.

Anchorage.—Good anchorage for small vessels can be obtained at the head of the creek in $2\frac{1}{2}$ to 3 fathoms, south of the white pillar on the Karanja shore, which marks the east port limit.

Tides.—It is high water, full and change, at Karanja at 11 h. 45 m.; springs rise 14 feet, neaps 11 feet.

AMBA RIVER, extending from Nocar point 21 miles to Nagothna, is $1\frac{3}{4}$ miles broad at the entrance with a depth of 2 fathoms; from here it takes a south-easterly direction for 4 miles, and narrows to half a mile between the mangroves which line its banks. The least depth as far as

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Dharamtar, 9 miles from the entrance, is 5 feet at 2 miles from Nocar point; through this portion a mid-channel course should be steered. At 1½ miles below Dharamtar the depth is one fathom.

At Dharamtar, there is a large wooden pier and two stone causeways, also a post office and rest-house. A small steamer runs daily between Bombay and Dharamtar, calling at Karanja and Rewas bandars, and a steam launch at certain times of the tide takes passengers from Dharamtar to Nagothna. Above Dharamtar the banks are low, and are lined by bunds to keep out the water at high tide. The deepest water is along the left bank for about 2 miles, as far as the islands, between which the least depth will be 3 feet, at low water springs, bottom mud and sand; when clear of the islands, Kasu shoal will be reached, it is composed of shingle, extends for three quarters of a mile, and dries almost completely at spring tides; vessels drawing 5 feet can only cross at half flood, or high water neaps, the channel is along the left bank and is very narrow.

Above this, the river narrows quickly and a general mid-stream course should be kept until the village of Jambultep is reached; here a point of rock and sand extends nearly across the river. Proceeding further up, numerous patches of rock and gravel will be met with, and the channel can only be found after some experience. The principal patches are opposite the villages of Shitjui and Bendsha where at springs the river dries, the bullock cart road crossing the river at the latter place; boats can only cross here at half flood or high water neaps, and if drawing more than 3 or 4 feet, only at springs.

At Nagothna there is a stone pier, but the steamer plying between this place and Dharamtar cannot utilize it, and lies about a hundred yards lower down the river.

Tides.—It is high water, full and change, at Dharamtar at 11 h. 52 m.; springs rise 13 feet, neaps 8 feet. At Ganda high water, full and change, occurs at 0 h. 10 m.; springs rise 11 to 13 feet, neaps 5 to 8 feet. The tides above Dharamtar run 3 to 4 knots at springs.

At Nagothna the rise at springs is 10 feet, and at neaps one to 2 feet. The tides are strong.

Nagothna is a town of some importance and much frequented by travellers proceeding from Bombay to the south-eastern part of the Deccan.

PANWEL RIVER, which empties into Bombay harbour immediately north of Hog Island, extends 10 miles to the town of Panwel. As far as Ulva bandar, 5 miles from the entrance, the river is navigable by small vessels, the least depth being one fathom at low water springs; above Ulva the river is divided into two branches by the island of

See plan of Bombay harbour, No. 2,621.

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Vagevlikhar and is mostly dry at low water; country boats, however, proceed, at high tide to Panwel bandar, to load and discharge cargo.

Between Ulva bandar and Panwel there is a good road, and a number of pony carts convey passengers to and from Shepherd & Co.'s steamers which call at Ulva bandar twice a day.

Directions.—Vessels proceeding to Ulva, after passing north of Hog Island, should steer E. by N. $\frac{3}{4}$ N., keeping the tall chimney on Hog Island in line with a conspicuous tree on Elephanta island bearing S. 69½° W. until the water begins to deepen near the rock marked with a bush beacon; a course should then be steered between the buoys towards the bluff on the north side of the river, passing close south of the fishing stakes situated just west of the bluff; then passing about three quarters of a cable from the bluff, a mid-channel course will lead to Ulva bandar, off which a vessel may moor in 14 to 23 feet, mud, or go alongside the pier.

Tides.—It is high water, full and change at Ulva bandar at 10 h. 15 m. Springs rise 16 to 18 feet; neaps 10 to 13; neap range 6 feet.

THANA CREEK, with depths of 20 feet, at the entrance, and 2 to 4 feet near Thana, opens into the northern part of Bombay harbour; it extends 10 miles from the village of Trombay to the town of Thana. At the junction with Bombay harbour, it is 1½ miles wide between the mud banks, gradually narrowing as Thana is approached.

On the east side, 2 and 3½ miles from Trombay, are rocky ledges; otherwise at low water the creek is lined by mud banks. Mangroves fringe the shores, which are formed by bunds, inside which the land is cultivated.

A small patch, which dries at low water, lies 5 miles from Trombay in the centre of the creek, with depths of 3 to 4 feet in the neighbourhood, and deeper water above; and 1½ miles south of Thana is a small islet.

From the Custom house, half a mile below the town of Thana, to the junction of the Thana and Bassein creeks, the channel is from one to 2 cables broad, rocky, and dries in places. It can be navigated by boats drawing 5 to 6 feet at high water; native craft of deeper draught get through at high water springs but constantly ground and have to be poled past the rocks.

Tides.—At Trombay the tides are about 20 minutes later than at Apollo Bandar, Bombay, and at the junction of the Thana-Bassein creeks, it is high water, full and change, at 1 h. 28 m.; springs rise 13½ feet, neaps 6 to 8 feet. The strength of the tides in the middle of the Thana creek is about one knot at springs.

See chart, No. 737.

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BACK BAY, formed by Malabar point on the north side, and the Prongs and another detached reef on the south and eastern sides, is open to the west, and is encumbered with rocks and reefs. The anchorage in Back bay is only used by native trading vessels, which run in and discharge cargo on the beach at Chawpati during fine weather. Bombay clock tower in line with Funnel hill bearing E. $\frac{3}{4}$ S. leads into Back bay in 11 feet at low water.

See plan of Bombay harbour, No. 2,621.

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CHAPTER VI.

COASTS OF NORTH KONKAN AND SURAT TO TAPTI RIVER.—MALACCA BANKS AND GULF OF CAMBAY.

(Lat. 19° 0′ N. to lat. 22° 20′ N.)

VARIATION, 1° 0′ E. in 1900.

COAST.—From Malabar point the coast trends in a northerly direction, 127 miles to Surat roads, at the entrance of the gulf of Cambay; it is generally low, and fronted by reefs or by shoal water, which extends some distance from the shore. From Arnala island to Surat roads the coast is thickly wooded, but is so low that much of it is overflowed at high spring tides.

At about 7 miles inland of Mahim lie a range of partially wooded hills whose summits are conspicuous from seaward; that of Kaldrug, 1,550 feet high, and situated 6 miles north-east of Mahim, resembles a castle when seen from the north-west. Valentine peak, 1,540 feet high, lies about 12 miles east of Dahanu, and has a pointed summit. The high land of St. John, with an elevation of 1,761 feet, and standing about 10 miles northward of Valentine peak, has a regular slope north and south from its centre, which is a round mount, and may be seen in clear weather from a distance of 40 miles.

The coast from Bombay to Tarapur may be approached in fine weather to a depth of 8 fathoms, and in some parts into 6 or 7 fathoms; off the foul ground of St. John, extending about 6 miles from the shore at Dahanu, it must not be approached by a large vessel into less than about 15 fathoms until the high land of St. John bears southward of E.S.E., thence into 10 fathoms. From Daman towards Surat roads the coast may be approached to 5½ or 6 fathoms, but in standing to the westward do not deepen above 16 fathoms towards Malacca banks. When within 10 miles of Surat roads do not increase the soundings above 12 fathoms.

With a contrary wind working between Bombay and Surat, to benefit by the tide do not stand farther than 10 or 12 miles from the coast.

SALSETTE ISLAND.—Between Bombay island and Bassein creek, 20 miles to the north, the coast is fronted by numerous small islands

See chart, No. 2,736.

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and shoals, at the back of which, on the large island of Salsette, there are severa remarkable peaks; the central and highest, named Thana peak, is 1,526 feet above the level of the sea, and when seen from the westward appears to have a flat top: the northernmost is a detached sharp peak, 1,517 feet high; these two peaks are 3 miles apart, and are in line on a N. by E. ¾ E. bearing.

Inland from Bassein, and 10 miles in a north-easterly direction from the creek entrance, stands a conical hill named Kamandrug or Bassein peak, 2,132 feet above the level of the sea; it is easily recognized from seaward, and with the high land of Salsette will unmistakably show when a vessel is north of Bombay.

At 4½ miles N.N.W. from Kamandrug is the remarkable plateau of Tungar, nearly 2 miles long N.N.W. and S.S.E., and a little over 2,000 feet above the level of the sea.

Worlee point, the north-west point of Bombay island, has a fort about a quarter of a mile from its extremity, which is a good mark from seaward.

Bandra point, over 90 feet high, at one mile north of Worlee point, is the extreme south point of Salsette island.

Bandra, 9 miles north of Bombay, with a population (1891) of 18,317, lies between the Bombay, Baroda, and Central India railway, and the sea. It is a port, and railway station. Small coasting vessels find scanty shelter from north-west winds off Bandra point.

A large number of European merchants reside at Bandra for the benefit of the sea air. On the east side of the town are the Bombay Municipal slaughter-houses, and a rest-house.

Juhu island, 2 miles north of Bandra, and connected with Salsette island at low water, is 2½ miles long N. by W. and S. by E., and is covered with cocoa-nut, brab, and date palms. The shore is sandy, and may be approached by boats, except near the north and south extremes of the island.

Andheri hill, 211 feet high, situated 1¼ miles east of Juhu island, is isolated and bare, with the exception of a large bush and a solitary brab palm.

Hervey patches, with 4 to 6 feet water, and on which the sea always breaks, lie 1¾ miles W. ¾ S., and 2 miles W. by S. ¼ S. from the north end of Juhu island.

VESAVA ISLAND, 1½ miles long and about half a mile across, lies on the eastern side of Vesava creek, and is covered with palms. Near the south end of the island there are several houses belonging to native

See chart, No. 737.

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merchants of Bombay; the fishing village of Vesava occupies the north end of the island.

There is a post office and custom house in the village, and the island is connected with Andheri, a station on the Bombay, Baroda, and Central India railway by a causeway.

Imports.—The principal imports are provisions, the value of which in 1892–93 amounted to Rs. 90,181.

Exports.—The principal exports consist of chunam, dried fish, and cocoa-nuts, the value of which in 1892–93 amounted to Rs. 441,686.

Supplies.—Good water can be obtained from wells outside the village. Provisions are scarce.

Vesava creek, the entrance of which lies between Vesava and Mahr islands, is about 6 miles long and has several villages on its banks, but most of the creek is dry at low water. The entrance is about three-quarters of a mile wide. It is, however, contracted by the sands off Vesava island to about one-third of a cable.

Anchorage.—Good anchorage may be obtained in 17 feet, bottom soft mud, off the south extreme of Mahr island, sheltered from northerly winds.

Tides.—It is high water, full and change, at Vesava at 11 h. 42 m., springs rise 14 feet, neaps 8½ feet. At springs the tide runs very rapidly in the creek, frequently attaining a rate of 5 knots.

MAHR ISLAND, on the west side of Vesava creek, is 2½ miles long, and very irregularly shaped. There is a ruined Mahratta fort at its south-east extreme, and several ruins on its summit, which is 120 feet high; reefs extend 6 cables off its western shore, but there are no off-lying dangers except near the south-west point of the reef. There are two small villages, Mahr near the south, and Yerangal near the north end. The island is well cultivated with cocoa-nut and fruit trees. A ferry connects the island with Vesava.

Ambu island, on the south-west extreme of the Mahr island reef, is low, covered with palms, and has on it an old watch tower.

Mehti Khada (Oyster rock), 14 feet high, situated half a mile west of Ambu island and composed of basalt, is very small and steep-to on its outer side.

Manori point, 99 feet high, consists of dark bare rocks, sloping abruptly to the beach, and shows bluff from seaward. From this point the coast trends in a northerly direction about 7 miles to Dongri point. At

See chart, No. 737.

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half a mile north of Manori point stands the large village of Manori, with a church in the centre, which is a good mark for navigating the creek.

Manori creek, south of Manori point, is small and runs inland to the north and north-east behind the hills of Dongri, it is navigable only for boats and small native craft; these can obtain shelter and anchorage in 15 feet water, over a sandy bottom, with Manori church bearing West.

Gorai rock, 172 feet high, situated 3 miles N.N.E. from Manori point and 1½ miles inland, is a sharp pinnacle of black rock and is a good mark for coasting.

Iksar temple, 164 feet above high water, stands on the northern summit of a round hill at 2¾ miles east of Gorai rock; it has a white dome conspicuous from seaward.

Green island, situated 3 miles N. by W. ½ W. from Manori point and three-quarters of a mile from the coast, is a quarter of a mile long and about 200 yards across; it lies parallel with the coast, is 3 or 4 feet high, covered with short green scrub, and surrounded by a ledge of rocks.

Outer island, situated 1½ miles N. by W. ¼ W. from Green island, is 6 to 8 feet high, composed of sand, nearly round and about 100 yards across. It stands on the southern end of a ledge of rocks (dry at low water), which extends parallel to and about one mile from the coast as far as Dongri point. On this ledge at about one mile N. by E. ¼ E. from Outer island stands **High rock,** a sharp pinnacle of black rock 23 feet high.

Utan tower, 110 feet above high water, is a ruined tower standing on a point on the south side of a small bay, in the bight of which at 2½ miles N.W. by N. from Gorai rock stands a large fishing village.

SOUNDINGS.—From abreast Manori point to abreast Pos Pir, at the entrance to Bassein creek, there are no dangers beyond the 3-fathoms line of soundings; the bottom is soft mud, with the exception of a patch of hard ground having on it 4 fathoms water, and extending out 3½ miles west of Manori point. The bottom slopes gradually out to a depth of 10 fathoms, at 10 miles from Manori point and 12 miles from Pos Pir. The passage within Green island, Outer island, and High rock is encumbered with rocks and is impracticable except for small local craft.

Fishing stakes are numerous and extend out to a depth of 10 fathoms.

Dongri Point, on the south side of the entrance to Bassein creek, is a bluff point as seen from seaward. It is about 100 feet high, rising to over 300 feet at half a mile to the southward, and sloping

See chart, No. 737.

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gradually to level country at 2 miles further south. On the point are the ruins of Deravi fort, which are not conspicuous until close to. At 1½ miles S.S.E. from Dongri point stands the ruins of a Roman Catholic church (Dongri ruin), 247 feet above high water: the square tower is conspicuous within 8 miles of the shore.

Dangerous rocks extend in a W.N.W direction from Dongri point and partly across the entrance to Bassein creek, the furthest out being 2 miles W. by N. from the point; these rocks uncover at low-water springs, but not at neaps; when there is no wind the sea does not break on them, and there are no indications of their vicinity.

BASSEIN CREEK has shoal water extending across its entrance, which lies between Dongri point and Pos Pir; although at high-water springs and in fine weather vessels drawing 12 feet water may enter the creek; it is (1894) only used by native craft. In the south-west monsoon the sea breaks heavily across the entrance.

BASSEIN, situated on the north shore of the creek, about 2 miles within the entrance, in lat. 19° 20′ N., long. 72° 48′ E., is a municipal town, and the headquarters of a sub-division; in 1891 it had a population of 11,291. The town stands about half a mile inland and north of the old fort; a good metalled road 4½ miles long leads to Bassein Road station on the Bombay, Baroda, and Central India railway.

Bassein has a good landing place, a stone pier and a custom house; there is also a custom hulk, painted red, moored off the pier.

The fort stands close to the landing place and is about 1½ miles around; near the middle are the ruins of the citadel. There is a travellers' bungalow on the south side of the town, about one mile from the landing place.

Trade.—The returns for the year 1896–97 showed an export trade of Rs. 1,527,774, and an import trade of Rs. 498,252. The exports are mostly local produce and consist of husked rice, molasses, cocoa-nuts and plantains, these are sent to Bombay and Guzerat; firewood and tiles to Bombay. The imports, all of which are for local use, consist of wheat, pulse, clarified butter, timber, piece goods, oil, oil-cake, and lime.

The vessels belonging to the port are mhangiris, machvas (fishing craft), padavs, and batilas of 50 to 70 tons, the crews are obtained from Bassein and the adjoining villages. Vessels of the same size from Guzerat, Kutch, Kathiawar, Diu, and the Southern Konkan visit the port. The aggregate tonnage in 1896–97 amounted to 53,003.

Supplies.—Beef, mutton, and vegetables may be obtained in moderate quantities, and at reasonable prices; also bread, at a day's notice.

See chart, No. 737.

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LIGHT.—On a patch of dangerous rocks about 400 yards from Bassein pier, stands an ordinary street lamp-post from which, at an elevation of 16 feet above the sea, is exhibited a *fixed white* light, visible from a distance of about one mile.

Tides.—It is high water, full and change, at Bassein at 11 h. 49 m., springs rise 11½ feet to 15½ feet, neaps 8½ feet to 11 feet.

In the north-east monsoon the tide at springs attains a velocity of 3 knots in the creek, and about 5 miles from the entrance 1½ to 2 knots. In the creek the tide continues to flow and ebb about one hour after high and low water respectively. The duration of slack water is 15 to 25 minutes.

Panju island, situated three-quarters of a mile from Bassein pier, is low and swampy; it is 2½ miles long, and half a mile across its broadest part near the centre of the island; the Bombay, Baroda, and Central India railway crosses on an embankment, which is connected with the mainland on both sides by two iron railway bridges.

On the east side of the railway there are workshops and houses for the engineers and workmen. There is also a small native village with a large stone-built house, the remainder of the island is covered with salt pans, and the shores are fringed with mangroves.

Dongri is a village on the east side of Dongri point; the inhabitants consist of fishermen and agriculturists. Good water may be obtained from a pipe leading into a small stone reservoir close to Dongri point. Near the village there are two remarkable basalt quarries, one on the point and another half a mile from it, the latter is being worked.

Bhayndar, on the south bank of the creek, at about 3½ miles east of Dongri point, has (1881) a population of 1,900, of whom 540 are Christians; it is a port and station of the Bombay, Baroda, and Central India railway, and contains a church and some well-built stone houses. There is a custom house in charge of a European officer, also a stone wharf with a railway siding down to it, from which large quantities of salt are sent by rail to Northern and Central India.

Ghorbandar, on the south side of the creek, 2½ miles from Bhayndar, was formerly an important place, with a large custom house, which is now (1894) closed. There is a small stone pier and a rest-house at Ghorbandar.

Ghorbandar temple, now (1894) the residence of the Collector of Thana, is a large building on the summit of a hill west of the village; it has a large dome 164 feet above high water and is painted white. There are several ruined buildings near the temple, and the remains of a convent, church, and fort.

See chart, No. 737.

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Sand banks.—Between Dongri point and the opposite shore of the creek there are several sand banks, parts of which dry 2 feet. These banks probably shift their positions every year during the south-west monsoon; above the narrows there are several sand banks, towards the northern shore of the creek.

Shoals.—Eastward of Ghorbandar temple there is a shoal over a mile long, parallel to the shore, composed of gravel and small stones, with one to 3 feet water. The channel south of Panju island is encumbered with sand banks and shoals, and should only be attempted by a stranger on a rising tide with a vessel of small draught.

Rock.—On the southern shore of the creek, 2½ miles above Ghorbandar, there is an isolated rock, covered at high water, lying about half a cable from a small point.

Narrows.—From one mile above Ghorbandar the creek narrows to less than 2 cables, and runs for nearly two miles with deep water (22 fathoms in the narrowest part) between steep-sided hills covered with jungle and bamboos. There are no dangers in this part of the creek, except some few rocks adjoining the shore that cover at high water.

Water.—On the north shore of the narrows, and about 2¼ miles above Ghorbandar, good water may be obtained from an iron pipe led from a hill stream to an iron tank.

Directions.—To enter Bassein creek keep outside the 3-fathoms line till Pos Pir bears East, then steer so as to keep Pos Pir a little on the port bow, and pass about 1½ cables south of it; thence steer E. ½ S. till High rock and Outer island are in line, when a S. by E. ¾ E. course should be steered for the sandy beach westward of Dongri point, until the water deepens near the beach, then hug the shore to the extreme of Dongri point in deep water.

From Dongri point keep on a line between Deravi fort and the middle of Bassein fort in 2 to 4 fathoms till close to the north shore of the creek, which should then be followed at a distance of one cable till opposite Bassein fort, where good anchorage will be found about one cable from the shore in 5 to 6 fathoms, mud bottom. Long vessels should moor head and stern.

The entrance to the creek is always difficult except at slack water as both flood and ebb streams run across the channel.

To ascend the creek from Bassein, the deepest water will be found by following the northern shore round Panju island, keeping in mid-channel between this island and the main shore till Ghorbandar temple bears South; thence cross to the southern shore, which may be followed at a distance of half to one cable as far as the creek has been sounded.

See chart, No. 737.

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Pos Pir, a small patch of rocks 36 feet high upon which stands a Mohammedan tomb, lies at the north side of the entrance to Bassein creek, nearly 2½ miles N.W. of Dongri point, and one mile from the shore. A reef extends about a mile north-west from Pos Pir.

Garaj hill, at 3 miles N.N.E. from Pos Pir, is a small, round hill 170 feet high, on which are ruins of a fort.

ARNALA ISLAND, upon which there is a small fort, lies 7 miles N. by W. ¼ W. from Pos Pir, and three-quarters of a mile from the mainland opposite, where stands the town of Kalapura. Arnala island is surrounded by rocks. The coast between Bassein and Kalapura is very low, and shoal water extends some distance off it.

To the north of Arnala is Agashi bay, a deep bight 4½ miles wide, narrowing to the mouth of Waitarna river. The bay is full of shoals and only navigable by boats or small vessels towards high water.

Ussapur rock, situated 4½ miles north of Arnala island, is high, detached from the mainland at high water, and forms the north extreme of Agashi bay. At low water the rocks dry to a distance of half a mile outside Ussapur, thence they extend across the bay to Arnala island.

Kilwa Mahim is a village at the mouth of a creek, 3½ miles northward of Ussapur; there is a small detached rock with a fort on it off the entrance to the creek. The town of Mahim is 2½ miles further north, and 3½ miles beyond it, the village of Siri. Satpate Khari, a small creek, lies 2 miles northward of Siri.

This part of the coast is very foul, reefs that partly dry at low water extending about 2 miles from it. A patch with 3 fathoms over it lies 4 miles west from Mahim.

Tarapur point lies 7 miles northward of Satpate; between them the coast is rocky, and should not be approached nearer than 8 fathoms; abreast Tarapur the foul ground projects nearly to that depth. On the north side of Tarapur point, the town and bay of Tarapur are situated; there is anchorage for small craft 2 miles north-west of the town, within a rocky barrier reef. Tarapur town is on the south side of the entrance to a creek. Chinchni town, on the north side of the entrance, has a custom-house and traveller's bungalow. The sea-coast is low and densely wooded.

Wadhwan point is a low point with mangrove bushes, at 6 miles north of Tarapur point; the dangerous Dahanu reef extends 4 miles north-westward from this point.

The hills at this part of the coast commence about 4 miles from the shore, whence they gradually increase in size, and become, at the distance of 5 miles, a continuous chain of low hills, lying parallel with the coast, some

See chart, No. 736.

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of which are wooded. The high land of St. John, 1,761 feet above the sea, bears N.E. ¼ E., and is distant 12½ miles from Wadhwan point.

Dahanu fort and town are situated on the north side of a small creek 4⅓ miles N.E. by E. from Wadhwan point, the entrance to which is 5½ miles from the outer edge of Dahanu reef. Small coasters find anchorage within the reef in 3 fathoms between 4 and 4½ miles west from Dahanu fort. Dahanu may be distinguished by two thick clumps of trees, one on either side of the creek, which can be entered at high water only, and is convenient for small coasters; there are wells of good fresh water close to the bank. There is a considerable export trade in small timber and bamboos.

FOUL GROUND OF DAHANU.—An extensive reef, with rocky ground, fronts this part of the coast, projecting about 3 to 6 miles, abreast the high land, and stretching from Wadhwan point nearly to Daman, a distance of 30 miles.

With the high land of St. John (Sunjan) bearing between N. by E. and E.S.E., a large vessel should not shoal under 15 fathoms, hence northward not under 10 fathoms until nearly abreast Daman.

When standing to the north-west a vessel should tack when the water shoals on the southern part of the Malacca banks.

Gulur point, situated 6 miles north of Dahanu, is low and grown with cocoa-nut trees; one high tree marks the point. Foul ground extends off the coast in the vicinity of Gulur point, nearly 4 miles.

OMERGAM, in lat. 20° 12′ N., long. 72° 44′ E., is a small town with a ruined tower, on the south bank of Warroli river. Foul ground extends nearly 4 miles off this part of the coast, which is low and sandy. The creek of Omergam is the northern boundary of St. John high land, between which and Daman are several remarkable hills.

Slope hill, with a remarkable bush on its southern side, lies 4 miles N.N.E. ¾ E. from Omergam, and Pyramid hill, 560 feet high, 2 miles further north. Wooded summit, 770 feet high, is 9 miles from Omergam in the same direction, 2 miles north of which stands Indagnur hill, 405 feet high, with a ruined fort at its top. Indagnur is 3 miles S. by E. from Daman fort, and on the south side of Kauli creek, which is the southern boundary of the Portuguese possession of Daman.

Between Omergam and Daman the land is low, with bushes, and with the two small creeks of Maroli and Kauli; the former lying 2 miles W.N.W. from Pyramid hill; the latter about the same distance and bearing from Indagnur. From Maroli to Daman the foul ground does not extend 3 miles from the shore.

See chart, No. 736.

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DAMAN is a Portuguese town and settlement situated 14 miles north of Omergam, by whom it has been permanently occupied since 1558. The settlement, of 82 square miles, is composed of two distinct portions, Nagar Haveli, with an area of 60 square miles, being separated from Daman proper by a strip of British territory 5 to 7 miles broad, and intersected by the Bombay, Baroda, and Central India railway.

Daman is sub-divided by the river Daman Ganga, and may be known by the forts on either side of the river entrance, and by two square steeples, and its white buildings; also by a hill 2 miles northward, 420 feet high, upon which stands an Iagah, or Mohammedan place of prayer, and by Indagnur hill to the southward.

Population.—The population of Daman town (1891) is 26,964: of the territory 63,284.

Supplies.—Provisions and vegetables are cheap and plentiful.

Repairs.—It is an excellent place for small vessels to effect repairs if needful, the country being well stocked with timber. Many vessels of 500 to 900 tons burden have been built in this river.

Trade.—A few grabs belong to Daman, and trade to Mozambique and other African ports.

LIGHT.—A *fixed white* light is exhibited at an elevation of 67 feet above high water, from a lighthouse 50 feet high, on the bastion of the fort, south side of entrance to Daman river; the light is visible seaward between the bearings of north and south, from a distance of 8 miles.

Anchorage may be obtained in Daman road about 4 miles off the town, in 5 fathoms water, with the lighthouse bearing East, and Wooded summit S.E. The depth at low-water spring tide is one foot on the bar, and 18 or 20 feet inside between the forts at the town, where the bottom is soft mud. The bar is very flat, mostly hard sand, except near the north point of the river entrance, where rocky ground projects some distance out.

Tides.—It is high water, full and change, on the bar of Daman river, at 1 h. 30 m.; springs rise 17 feet, neaps about 12 feet.

Directions.—Vessels up to 500 tons sometimes proceed into Daman river at high water in fine weather, and moor abreast the forts. To enter the river, keep the entrance open bearing East, and steer for it; anchor in mid-channel between the forts. A vessel will be on the bar when three brab trees close together on the shore half a mile north of Daman, are open to the left (north-westward) of the Iagah hills.

It is not advisable to attempt entering this river without a pilot.

See chart, No. 735.

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SURAT DISTRICT lies between the parallels of 20° 15′ N. and 21° 28′ N.; it is bounded on the north by Broach district, and the native state of Baroda, and on the south by Thana district and the Portuguese territory of Daman. Along the southern part of the coast of Surat, small hillocks of drifted sand fringes the greater part of the shore, in some parts watered by springs, and covered with a thick growth of creepers and date palms. Through the river mouths the tide runs up behind the sand hills, and floods a large area of salt marshes. In the northern part of the district there is an alluvial belt, through which the important river Tapti forms a deep and fertile delta.

OMERSARI CREEK, at 8 miles north of Daman, is properly the northern boundary of the district of North Konkan. Parner hill fort, on its north bank, and 3½ miles within the entrance, is 623 feet above the sea.

Omersari bar is dry at three-quarters ebb: a small vessel bound into this creek should bring a high white building at Balda Parda town to bear E.S.E., and then steer in with the entrance of the creek open; when Parner hill bears E. by N. a vessel will be within the bar, and may anchor when the land to northward is shut in behind the north entrance point of the creek.

Caution.—Westward of Omersari, nearly 5 miles off shore, is a shoal patch with less than ten feet upon it, and W. by N., 9 miles from Omersari, another patch of 3¼ fathoms. Between Daman and the entrance of Surat river the coast forms a deep bight, throughout which the water is very shoal.

Bulsar Khari, the estuary of Auranga river, at 6 miles north of Omersari, forms the port of Bulsar, the town being on the south side of the river about 2½ miles from the coast. An extensive flat of mud and sand dries at low water half a mile outside the entrance, and the creek also is then nearly dry, but in the river there is a depth of 7 to 9 feet. Vessels can only cross the bar towards high water, and the native craft generally ground in the mud at half ebb.

Large vessels must anchor about 8 miles off shore, the 5-fathoms contour-line being at that distance.

LIGHT.—From a wooden staff, 62 feet high, on the south entrance point of Bulsar Khari, is exhibited at an elevation of 58 feet above high water, from the 1st September to 31st May, a *fixed white* light, which should be seen in clear weather from a distance of 7 miles.

Rola hills, situated 5 miles north-east of Bulsar light-staff, consist of two or three elevations about 100 feet high. On the beach at Tithal, about

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See chart, No. 735.

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2 miles south of the light-staff, there is a bungalow which is conspicuous from seaward.

At 3 miles from the light-staff there is a rocky bank extending three-quarters of a mile further west, upon which there is 6 feet at low water; the intervening ground, of soft mud, has 12 to 3 feet over it. The bank lies with the light-staff between the bearings E.N.E. and E. by S.

Bulsar town contains revenue and police offices, a subordinate judge's court, post office, and dispensary. There is also a railway station on the line between Bombay and Surat.

The manufactures of Bulsar are cloth for wearing apparel and for sails, silk, bricks, tiles, and pottery.

Imports.—The chief imports consist of piece goods, tobacco, wheat, fish, and sugar.

Exports.—The exports are, timber, grain, molasses, oil, firewood, and tiles.

Tides.—It is high water, full and change, at Bulsar Khari at 1 h. 45 m.; ordinary springs rise 18 feet, neaps 14½ feet. The flood stream in Bulsar road runs one hour after high water in the estuary.

Gandevi river, situated 8 miles north of Bulsar Khari, has a bar about one mile from the entrance, upon which there is but one or 2 feet at low water. There is a large tree on the north shore of the river, near the entrance.

Bilimora, a small seaport town in the territory of the Gaekwar of Baroda, is situated about 7 miles within the entrance of Gandevi river. It contains a custom-house, post office, and railway station.

There is a creek called Kundikari, 2½ miles north from Gandevi river. The great rise of tide along this coast renders nearly all these creeks accessible at high water; but native pilots must be employed.

Tides.—It is high water, full and change, at Gandevi river, at 2 h. 0 m.; ordinary springs rise 19 feet, neaps 15½ feet.

Nosari river lies 11 miles north of Gandevi river; it is difficult of access, on account of the winding channel among the sand banks, in which there is generally 3 or 4 feet at low-water spring tides. The river is navigable for large native craft as far as the towns of Nosari and Jalalpur, which stand on the left bank, about 12 miles within the entrance, but it should not be attempted without local knowledge.

Bibi Ajani, a tomb of the Borahs of Surat, situated 2½ miles south-east of the entrance of Nosari river, has a white dome, conspicuous, especially from the south-west, amongst the dark green trees. Between Bibi

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See chart, No. 735.

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Ajani and Tapti river there is a low plain of sand with some scattered palmyra trees.

About 9 miles north of Nosari river there is a stream named Sachin river.

SACHIN is a small native state within the British Political Agency of Surat, and occupies an area of about 300 square miles. The Nawab of Sachin is by descent a Habshi or Abyssinian. The capital stands about 9 miles within the entrance, near the right bank of Sachin (Mindhola) river, which is crossed by the Bombay and Baroda railway. The climate is healthy, and the usual cereals are cultivated, as well as cotton and sugar cane. Yarn and coarse cloth are manufactured in Sachin.

Bhimpur is a small town situated on the north side of Sachin river entrance, the mosque on the south side of the town is a conspicuous object from Surat roads.

TAPTI RIVER rises in Betul district of the Central Provinces in lat. 21° 48′ N., long. 78° 15′ E., and after running in a general westerly direction for 450 miles empties itself into the gulf of Cambay, about 2 miles north of Sachin. The river is tidal for a distance of 32 miles; small native craft and steam vessels of light draught ascend to Surat city, 15 miles within the entrance; boats at times pass up to Amroli, 11 miles above the city. The river is encumbered with numerous sand banks, several of which dry at half tide; so that vessels of 6 feet draught can only proceed up or down the river at more than half tide.

LIGHT.—From a circular stone building, 90 feet in height, painted white, situated near Vaux's tomb on Suwali point, the north entrance point of Tapti river; is exhibited, at an elevation of 130 feet above high water, a *fixed white* light, which should be seen in clear weather from a distance of 15 miles.

Caution.—Directions for entering Tapti river cannot be given, as the sands and channels are continually altering. The navigable channel can only be pointed out by the native pilots, who are always available at the bar.

Dumas village, the marine sanitorium of Surat, stands on the left bank of Tapti river, at 3½ miles east of the lighthouse, and has several bungalows among the cocoa-nut trees.

Surat city is situated in a bend on the left bank of the Tapti, and extends about 1½ miles along the river front; the castle, a mass of irregular fortifications, flanked at each corner by large round towers, standing in the centre. A magnificent iron girder bridge crosses the river at Surat city.

See charts, Nos. 735 and 51.

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Population.—The population of Surat and cantonment in 1891 amounted to 109,229.

Manufactures.—Surat contains steam factories for spinning and weaving. Silk brocade and embroidery are also largely manufactured by hand-looms.

Exports.—The chief exports consist of grain, pulse, mahua fruit, timber, and bamboos.

Imports.—The principal imports comprise tobacco, cotton-seed, iron, cocoa-nuts, and European goods.

Communication.—The Bombay, Baroda, and Central India railway runs to this place, and steam vessels run between Surat, Gogha and Bhaunagar.

Tides.—It is high water, full and change, in Surat roads at about 2 h. 45 m., but the flood stream lasts one hour longer. The rise at extraordinary springs is 23 feet; at ordinary springs is 19 feet; and at neaps 15 feet. The tide frequently falls more than 6 feet before the ebb stream begins to make.

At Surat town it is high water, full and change, at 4 h. 0 m.; rise at ordinary springs 19 feet.

Anchorage for large vessels in Surat roads is in 6 or 7 fathoms over soft ground, with Vaux tomb bearing about N. $\frac{1}{2}$ W. and Bhimpur mosque N.E. $\frac{2}{3}$ E.; smaller vessels lie nearer the bar in 4 or 5 fathoms.

In the outer position during springs the tides are very strong, particularly the ebb, which sets S.S.E. 4 or 5 knots an hour; the stream is slacker nearer the bar.

STORMY WEATHER.—In Surat roads, and at the entrance of the gulf of Cambay, southerly winds and unsettled weather, preceding the setting in of the south-west monsoon, begin earlier than at Bombay. It is considered dangerous for sailing vessels drawing much water to remain in the roads after the middle of April; for in the latter part of this month, and early in May, strong southerly winds frequently blow during the springs, and produce a considerable sea.

At such times it is prudent to keep a pilot on board, that he may conduct the vessel, if small, into the river should a storm be apprehended; or to Gogha, if preferred, where there is shelter from the reef and island of Piram. The approach of a gale in these months is sometimes indicated by dark cloudy weather, gloomy and black to the south-eastward, with lightning, and faint variable breezes, mostly from the southward: with these indications, a vessel should prepare for heavy weather.

See charts, Nos. 735 and 51.

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APPROACHING SURAT from the Southward.—Between Daman and Surat river the land near the sea is low, covered with trees, and in some parts, particularly in the vicinity of the rivers, it is inundated during high tides in the stormy season.

Having passed the foul ground off the high land of St. John, and being abreast Daman, steer for Surat roads, keeping about 10 or at most 12 miles from the shore, and do not deepen above 14 or 16 fathoms. In working, stand in to 5½ or 6 fathoms on the soft shore bank; but, if anchoring on account of tide, or other cause, remember the fall of water at springs is sometimes 19 or 20 feet.

Omersari and Bulsar flats extend a long way out, there being only 3¼ fathoms at 9 miles from the shore, with Parner hill bearing E. ⅔ S.; there is a long narrow 7-fathoms shoal about midway between the 5-fathoms contour-line outside these flats and the Malacca banks. Having passed 10 or 12 miles to the northward of Parner hill, steer along shore, in soundings from 7 to 9 or 10 fathoms. When working within 12 or 15 miles of Surat roads, do not stand towards the shore, into less than 6½ fathoms, or deepen over 12 fathoms when standing towards the Malacca banks.

MALACCA (Malaikai) BANKS are long, narrow, shoal tongues lying at the entrance to the gulf of Cambay, between the parallels of latitude 20° 20′ N. and 21° 15′ N. They may be said to present no dangers, south of a line between Pyramid hill on the Surat coast, and Jáfarábád on the south-east coast of Kathiawar. Their northern limit of danger lies, east and west, half a mile north of a line between Tanna creek (7½ miles north of Vaux tomb) and Goapnath point. North of this limit, as far as Narbada river, the gulf has not been thoroughly examined.

The western limit of the Malacca banks lies 30 miles S.S.W. ¼ W. from Goapnath point, and 22 miles S.E. by E. ¾ E. of Salbet island, on the south-east coast of Kathiawar. There are four banks, Western, Narbada, Breaker, and Eastern; there are deep channels between, but they are narrow at their northern mouths, and it is inexpedient to use them.

Western bank is separated from the Kathiawar coast by Grant channel, which is about 6 miles wide and steep-to on both sides, with general depths of 8 to 10 fathoms, sand towards the bank, and mud towards the land.

Narbada bank shows a large extent of sand, dry at lower water, nearly midway between Surat road and Mahuwa harbour in Kathiawar.

See charts, Nos. 735 and 50.

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Breaker bank has, at the distance of 20 miles S.W. ½ S. from Tapti lighthouse, a knoll of sand, which is seen at high-water neap tides, but submerged at high springs. This sand is in latitude 20° 50′ N., and longitude 72° 24′ E., and from the masthead may be seen from a long distance when the sun shines on it.

Eastern bank.—The easternmost danger of these banks lies from West 4½ miles, to S.W. ½ W. 5½ miles, from Vaux tomb, and has on it 6 to 12 feet at low water. The most eastern patch of sand, which dries at low water, lies 18 miles west from the entrance of Kundikari, and 18 miles S.S.W. from Vaux tomb.

The north-eastern danger, or head of the bank, lies 6 miles west from the little hill named Tom Coryat's tomb, which is close to the sea, about 5 miles north of Tapti lighthouse.

The head or northern limit of Malacca banks should not be approached with an ebb tide; being steep-to, the soundings do not give sufficient warning.

Sutherland channel, the passage between the banks and the eastern shore is about 3 miles broad; the shore bank projecting out 1½ miles at low water. These are sometimes termed the inner and outer sands of Suwali, and are both dry at low water. The eastern reef of Malacca banks is steep-to on its eastern edge, occasioned by the great rush of tide sweeping along it. As the deepest water is within one mile of the dangers of the bank, care is necessary in working to windward.

GULF OF CAMBAY.—The gulf of Cambay, which separates the peninsula of Kathiawar from the northern Bombay coast, extends in a northerly direction 65 miles, and is 30 miles wide at its entrance between Tapti river and Goapnath point, the south-east extreme of Kathiawar. In the southern part of the gulf ,there are soundings of 10 to 20 fathoms, with casts of 5 to 8 fathoms near the middle. Between Piram island and the Broach coast the depths vary from 10 to 30 fathoms, and in the narrow channel west of Piram island there are depths of more than 46 fathoms.

CAUTION.—The northern part of the gulf is much encumbered with sand banks, which frequently change by the force of the Bores and of the freshets out of the rivers; it should not be navigated north of Bhaunagar without local knowledge.

EASTERN SHORE.—The coast immediately north of Tapti lighthouse has a few sand-hills, termed Suwali hills, off which Suwali bank dries for a distance of 1½ miles at low water: this bank consists

See charts, Nos. 735 and 51.

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of sand at its edge, with mud inside, towards high-water mark. Abreast Tapti lighthouse the shore bank only dries half a mile off. Tanna creek, in a bight 7½ miles north from Tapti lighthouse, is said to lead into Tapti river. From Suwali hills to Bhagwa, the coast is lined with thick groves of brab, or palmyra trees; but from this village to the banks of the Narbada, upwards of 20 miles, it is low, marshy, intersected by numerous creeks, and overflowed at spring tides from one to 4 miles inland.

Dandi point, a low sandy point, about one mile west of the south extreme of Dandi island, and 14 miles N. by W. from Tapti lighthouse, has off it some dangerous sands, the passages between which and Gulwala bank should not be attempted without a pilot. The shore flat extends nearly 2 miles from the point. Bhagwa low point lies 2 or 3 miles northward of Dandi point.

Bhagwa is a small village about 16 miles north of Tapti lighthouse, and 3 miles N.E. ½ E. of Dandi point.

LIGHT.—On Dandi point at the entrance to Bhagwa creek, is shown from a mast at an elevation of 107 feet above high water, a *fixed white* light, which is visible in clear weather from a distance of 7 miles; it is exhibited from 1st September to 31st May.

Gulwala bank, situated 5 miles westward of Dandi point, is 5 miles long, north and south, and nearly a mile across the broadest part; there are depths of 1½ to 3 fathoms on the south part, and 3½ to 4½ fathoms in the middle, but the northern end is partly dry.

From the south extreme of Gulwala bank, Dandi light bears N.E. by E. ½ E., and from the north extreme E.S.E., Tapti light bearing S.E. ½ S. leads west of Gulwala bank.

Bhagwa sands lie between Gulwala bank and the mainland; the intricate navigation, eastward of Gulwala bank, with its rapid tides, should not be attempted without the assistance of a native pilot; and at night, or in a large vessel, it is advisable to keep well to the westward of Gulwala bank. There is a channel inside Bhagwa outer sand and Tanna bank, through which small coasting vessels pass in 3 and 4 fathoms water. From Tapti lighthouse a continuous bank extends along the shore as far as the estuary of the Narbada.

Kim river, the entrance to which is situated about 4 miles north of Dandi point, has a course of 70 miles, and is the southern boundary of the Broach district. The estuary of this river, named Contijal creek, dries at low water; native boats can enter at half flood. The town of

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See chart, No. 51.

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Kim lies about 20 miles within the entrance, on the right bank of the river.

NARBADA (Nerbudda) RIVER empties itself into the gulf of Cambay about 11 miles north of Dandi point. The estuary of the Narbada is 13 miles across between the entrance points, and contains extensive sand-banks, which dry at low water; there are two channels through these banks, the northern, named Broach channel, runs close along the northern shore of the estuary, and has a depth of 6 feet over the bar; the southern channel, leading to Hansut, has in it several sand-banks, dry at low water. The Narbada is tidal as far as Rayanpur, 55 miles from the sea. From July to September boats can proceed as far as Talakwara, 65 miles above Broach.

The city of Broach is situated on the right bank of the Narbada, about 25 miles within the entrance, and, with the suburbs, occupies an area of more than 3 square miles. The river face of the city wall is 30 to 40 feet high, and extends about a mile along the bank. Within the walls the streets are narrow and in some parts steep; the houses are generally two storeys high, with walls of brick, and tiled roofs. Since the opening of the Surat, Baroda railway, which runs through Broach, the trade by sea has greatly decreased, but several small vessels carry on local traffic.

Population.—The population of Broach in 1891 amounted to 40,168.

Exports consist chiefly of flowers of the mahua tree, wheat, cotton, tiles, and firewood.

Imports are molasses, rice, betel-nut, timber, coal, iron, cocoa-nut, and stone for building.

BROACH (or Lahara) POINT, to the north of which lie Dehej sand-hills, is situated 20 miles N. by W. from Dandi light, and 11 miles E. by N. $\frac{3}{4}$ N. from Piram island lighthouse. This is the highest part of the coast, and consists of sand-hills (one of which is about 80 feet high) covered with bushes, near which there are several topes of banyan trees, and eastward, near Jageshwar temple, a small grove of brab trees. A sand flat, covered at high water, surrounds Broach point, and terminates in a spit $2\frac{1}{2}$ miles south-west of it.

LIGHT.—At Broach point, on the north bank of Narbada river entrance, is exhibited from an iron structure, at an elevation of 30 feet above high water, a *fixed red* light, which is visible in clear weather from a distance of 8 miles, when bearing from S.E., through east and north to W.N.W.; it is shown from 1st September to 31st May.

See chart, No. 51.

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Anchorage may be obtained in Broach roads, off the bar at the entrance of Narbada river, in about 7 fathoms at low water, with Broach point lighthouse bearing N.N.E., distant 4 miles, and Piram island lighthouse W. ¼ S. Pilots will generally be found at the bar.

Tides.—It is high water, full and change, in Broach roads at 3 h. 40 m.; springs rise 25 feet. The stream flows till about 4 h. 30 m., and sometimes runs 5 or 6 knots an hour.

The ebb tide sets very strong out of the river, and runs occasionally for an hour after low water. During the flood there are heavy overfalls on the outer edge of the bar.

On the east side of the gulf of Cambay the flood stream sets about N. by E., and the ebb S. by W., except where the direction is altered by the form of the sands.

The COAST from Broach point trends in a northerly direction about 4 miles to Dehejbara creek, and consists of moderately high sandhills; thence to the entrance of Dhadar river at 6 miles further north, it is low and composed of sand and mud. Between the bar of Broach channel and the Dhadar there is a flat, dry at low water, projecting from 1½ miles to 2½ miles off the shore, with deep soundings close to. Dehej, at 2½ miles east of Dehejbara creek entrance, and Gundar, about 11 miles further north, are the only large villages near the coast; both have conspicuous buildings, which can be seen from a considerable distance.

This part of the gulf is shallower than formerly, and is not used by vessels of more than 50 tons.

Dehejbara shoal, with its south end situated nearly 3 miles west of Dehejbara creek, is 1½ miles long, with not less than 3 fathoms water over it, and lies parallel to the shore bank; the channel inside it is half a mile wide with a depth of 10 and 11 fathoms water. From the south end of this shoal, Dehejbara brab trees bear E. ¾ S.; and from its north end a single brab tree bears East.

Makra bank, situated 5 or 6 miles from the coast between Broach point and Tankari point, is 11 miles long north and south, with a detached portion on its north-eastern side, including which it is here nearly 3 miles across, with general depths of 6 to 12 feet. Near the centre of the bank there is a patch which dries at low-water springs.

DHADAR RIVER rises in the western spurs of the Vindhya mountains, in lat. 22° 20′ N., long. 73° 40′ E., and after running a course of 70 miles, falls into the gulf of Cambay in lat. 21° 54′ N. It receives on the right a small tributary named Viswamitri, on the banks of which stands the city of Baroda, with a population (1891) of 116,420. The estuary of

See chart, No. 51.

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the Dhadar is 5 miles wide between the entrance points, but the channel leading through the sand-banks which extend from the shores on either side, is very narrow, with depths of only 7 to 3 feet for a distance of 5 miles within the entrance; beyond this the channel is nearly dry at low water.

LIGHT.—From a mast on a masonry structure at Tankari point, on the north bank of Dhadar river, is exhibited, at an elevation of 41 feet above high water, a *fixed white* light, which is visible in clear weather from a distance of 10 miles. The light is shown from 1st September to 15th June.

TANKARI is a town and port situated on the east side of a small creek, on the right bank of Dhadar river, about 7 miles within the entrance of the estuary, and nearly 10 miles from the anchorage in the roads. The river is three-quarters of a mile wide at Tankari. There is a custom-house in the creek, which is only navigable for small native vessels. From Dhadar river, cotton, grain, and oil are exported in small quantities.

Tankari road may be known by the entrance of the river being open, by a pagoda called Devjagan on the north bank, and by the light-house near it. Vessels may anchor in 8 or 9 fathoms at low water, with the pagoda or lighthouse bearing N.E. ½ N., distant about 3½ miles, whence the buildings of Gundar will bear about E. ⅔ N. A native pilot is necessary to conduct a vessel farther into Dhadar river.

Tides.—It is high water, full and change, at the entrance of Dhadar river, at 4 h. 30 m., but the flood stream runs one hour later; springs rise 27 feet, neaps rise 20 to 22 feet. The greatest velocity of the stream in the roads at springs is 6 knots.

Mahi river has its source in the Mehad lake, 1,850 feet above the sea level, in the Amjhera state, Malwa, in lat. 22° 52′ N., long. 75° 5′ E., and has a course of about 350 miles, when it falls into the head of the gulf of Cambay, 18 miles north of Dhadar river. For the first part of its course the Mahi passes through the lands of the Mahi Kanta and Rewa Kanta chiefs; it then enters British territory, and separates the district of Kaira, on the right, from the Panch Mahals and Baroda, on the left. For the remainder of its course the Mahi river runs between the state of Cambay and the Broach district.

Cambay, the chief town of the state of that name, stands on the north side of the estuary of the Mahi river; its population (1891) is 31,390. The town was originally surrounded by a brick wall, a portion of which encloses a space of about 3 miles in circumference. It was formerly

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an important commercial town, but has suffered from the silting up of the gulf and to its shifting, shallow bar.

LIGHT.—A *fixed white* light is exhibited from a boat to mark the shifting of the bar off Cambay, which is visible in clear weather from a distance of 3 miles. The light is shown from 1st October to 15th June.

Sabarmati river rises in the north-east part of Ahmadabad district, near the Aravalli range, and flows towards the south-west for a distance of 200 miles, when it falls into the gulf of Cambay, in longitude 72° 20′ E. There are several tributaries both above and below the city of Ahmadabad, which stands on the left bank of the river, about 50 miles from the head of the gulf. The small channel between the banks at the entrance of the Sabarmati is nearly dry.

In the upper part of the gulf of Cambay the flood stream sets north-eastward into the Mahi river, and the ebb to the south-west.

Singotir Mata, a pagoda on the point between Mahi and Sabarmati rivers, 12 miles west from Cambay town, is a high building with a flagstaff. The coast is rather elevated and well cultivated, and great quantities of cattle are reared in the vicinity. Deo mata is a small pagoda on the same shore 6 miles northward of Singotir, and abreast this place the stream was found in December to be nearly fresh at low water.

MAL BANK, situated in the middle of the northern part of the gulf of Cambay, and composed of sand, is nearly 15 miles long, north and south, and 8 miles across the broadest part. There are channels on either side of it, each about a mile in width.

WESTERN SHORE.—The coast of Kathiawar, from Goapnath point trends in a N.N.E. direction 27 miles to Kura point, thence north-westerly 12 miles to the entrance of Bhaunagar creek. Between Goapnath point, and Metiveli, a small village 20 miles north of it, the shore is low and fringed with sand-hills; thence to Kura point the land is tolerably high, with several ravines near the sea. Kura point has on it a thick clump of trees, conspicuous from the northward or southward; and a white bungalow which shows well during the forenoon, when seen from the eastward. Between Kura point and Gogha at 3 miles north-west of it, the coast is low, marshy, and fronted by reefs which uncover at low water and extend 1½ miles from the shore; abreast Gogha the foreshore is mud and shingle, and dries 4 cables from the beach. At about 10 miles south-west of Gogha lie the Kokra hills, the conical summit of which is 986 feet high; between these hills and the shore the country is a flat, cultivated plain, with scattered villages generally surrounded by trees.

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Goapnath point is moderately high, and has on it a lighthouse and a bungalow. At three-quarters of a mile N.N.W. from the extremity of the point, stands a pagoda 150 feet above the sea.

Goapnath shoals extend nearly 4 miles in a north-easterly direction from the point, and are tolerably steep-to; on the south side of the point there are depths of 5 to 7 fathoms close to the shore.

LIGHT.—Goapnath lighthouse, a buff-coloured building 32 feet high, stands on a hillock 240 yards within the point, and exhibits at an elevation of 68 feet above high water a *fixed white* light, visible between the bearings of N.N.E. (through west) and S S.W., which should be seen in clear weather from a distance of 6 miles.

Palitana mountain, 1,637 feet high, lies 22 miles north-west of Goapnath point. It is celebrated for its groups of Jain temples and monastic establishments.

Talaja hill, 400 feet high, situated 10 miles N.N.W. from Goapnath point, is a steep conical hill rising out of a level plain. On its summit there is a Hindu temple, having tanks of excellent water; the hill has caves excavated in the solid rock, where formerly the pirates of these parts dwelt.

Satrunji river has its source north-east of the Gir hills, and after running in an easterly direction passes north of Palitana mountain, thence south-easterly past Talaja hill, and empties itself into the gulf of Cambay at 6 miles north of Goapnath point.

Sultanpur is a small port on the Satrunji, where good water may be obtained from a well close to the landing place about a mile within the entrance of the creek.

Sultanpur shoal, part of which is nearly dry at low-water springs, consists of rock, sand, and clay; it is 2¾ miles long north and south, with an average breadth of about one mile. This shoal lies about 4½ miles east of Satrunji river entrance, and is nearly connected with the shoals extending from Goapnath point. There are passages between these shoals; no directions, however, can be given, as they change annually. Talaja hill, bearing W. ½ N., leads northward of Sultanpur shoal. Between this shoal and the shore, small vessels may anchor in 2½ or 3 fathoms, water.

Tides.—Within Sultanpur and Goapnath shoals, it was found to be high water, full and change, at 2 h. 25 m.; but the ebb stream did not make till more than one hour afterwards, and continued to run for more than 1½ hours after the water had commenced rising by the tide-gauge on shore. At neaps the flood stream was found to run 2 hours after high

See chart, No. 51.

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water. Rise and fall at ordinary springs was 16 feet, at high springs 18 or 19 feet; rise at neaps 9 or 10 feet.

Matowra is a small village at 6 miles north of Satrunji river entrance, and stands on the south extreme of the hilly country. The shore bank extending from Matowra shelves gradually, and may be approached into a depth of 5 fathoms.

Goriali, a small village situated nearly 5 miles north of Matowra, and about 2 miles inland, may be known by a white tower which is conspicuous from seaward. About midway between Goriali and the sea stands Sonchia village; the land in this vicinity is hilly and covered with grass. Abreast Sonchia, rocks extend a mile from the shore with 7 fathoms water close to.

Piram island, situated 2½ miles south-east of Kura point, and composed of sand, is one mile long N.W. by N. and S.E. by S., one-thlrd of a mile across the broadest part, and is surrounded by a reef which projects 2½ miles in a northerly, 1½ miles in an easterly and southerly, and three-quarters of a mile in a westerly direction. At the southern end of the island there are a few trees and a little cultivation; near the middle stands the lighthouse and a small village, and the north-east side is fringed by a few mangrove trees. The best landing place is on the west side, near the north point of the island. The narrow channel between the reefs west of Piram should not be used without local knowledge, as the tides run through with great velocity, with very little slack water.

LIGHT.—From a circular stone lighthouse, 73 feet high, on Piram island, a *fixed white* light is exhibited at an elevation of 129 feet above high water, which should be seen in clear weather from a distance of 17 miles; between the bearings N. 50° E., through west and south, to S. 56° E. This light is reported to be visible only 8 miles in hazy weather.

Position of lighthouse, latitude 21° 35′ N., longitude 72° 20′ E.

Tides.—It is high water, full and change, at the landing place on the west side of Piram island, at 3 h. 32 m.; springs rise 27¼ feet, neaps 22¾ feet. Neaps range 14¾ feet.

GOGHA, formerly a place of considerable trade, is a walled town with a population (1881) of 7,063. At the north end of the town there is a small creek, which is dry at low water, and a custom-house bandar, where the native craft trading to the port lie in safety. The natives of Gogha are considered the best sailors (laskars) in India.

Trade.—The value of the exports (1896–97) is 393,930 rupees; of imports 570,460 rupees. Aggregate tonnage of vessels entering the port 12,928, in craft averaging about 12 tons.

See chart, No. 51; and plan, Piram island to Bhaunagar, No. 1,035.

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Supplies.—Water and a few supplies may be obtained at Gogha, and small repairs executed. Firewood is scarce.

Anchorage may be obtained in Gogha roads, in 2¾ fathoms low-water springs, with the summit of Kokra hills in line with the large tree at Gogha bearing W.S.W., and Piram island lighthouse S. by E. ½ E.; or further out in 9 fathoms with the lighthouse bearing S. by E. ¼ E.

Native craft anchor in 10 to 14 feet, low-water springs, near the entrance to Gogha creek.

LIGHT.—From an iron structure on Gogha bandar, at an elevation of 25 feet above high water, a *fixed white* light is exhibited which is visible in clear weather from a distance of 10 miles, between the bearings of N.W. (through west) and S.S.E.

Tides.—It is high water, full and change, at Gogha, at 3 h. 58 m.; equinoctial springs rise 33 feet, ordinary springs 27 feet; neaps rise 25 feet and range 16 feet.

There is a diurnal inequality in the height of high water, which generally attains its maximum (about 6 feet) at about the time that the moon arrives at its greatest declination; the night tides during the fine season (October to April) being higher than the day tides.

Perigee rock, situated on the west side of the fairway leading to Bhaunagar creek, at a little over 2 miles N.E. ¼ E. from Gogha lighthouse, is about three-quarters of a cable long N.W. by N. and S.E. by S., and 70 yards across, and shows three heads above water at the lowest spring tides.

BHAUNAGAR CREEK.—From Gogha creek the edge of a mud flat, overgrown by low mangrove bushes, and intersected by numerous small creeks which dry at low water, trends in a north-westerly direction 9 miles to Bhaunagar point, thence south-westerly 2¾ miles to the bandar. The country in this vicinity is low and level, and the mud flats on either side of the creek are partly covered at high-water springs.

LIGHTS.—On the west side of Bhaunagar channel a *fixed white* light is exhibited at an elevation of 43 feet above high water, from an iron mast on square dwelling on piles, painted white, and is visible in clear weather from a distance of 8 miles.

Another *fixed white* light is shown from the hydraulic tower on Bhaunagar bandar, which is also visible from a distance of 8 miles. *Red* and *blue* shades are placed in front of this light, to show coloured rays off the bandar.

See plan, Piram island to Bhaunagar, No. 1,035.

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Shoals.—Entrance shoal dries nearly a mile in a south-easterly direction from the east entrance point of the creek. Between this shoal and the point there is a narrow boat channel at low-water springs.

A bell buoy is moored on the west side of entrance shoal.

Point middle ground, on the east side of Bhaunagar point, dries nearly half a mile in a north and south direction; the fairway lies on the east side of this ground.

Point flat, dry at low water, lies in the bend of the creek on the western side of Bhaunagar point; between this flat and the northern shore, the channel is about one cable in width.

Abreast the bandar a flat, dry at low water, extends from the north bank of the creek, narrowing the channel to three-quarters of a cable.

The town of Bhaunagar is connected by railway with Dhorajī, in the western part of Kathiawar; also with the Surat and Baroda railway. The harbour accommodates vessels of small draught; at this place there is an extensive trade in cotton. Just above the bandar there is a tidal dock for native craft; and a steam ferry, which is worked at high water.

Population.—Bhaunagar contains a population (1891) of 57,693.

Storm Signals.—For description, *see* page 56.

Tides.—It is high water, full and change, at Bhaunagar at 4 h. 32 m.; springs rise 32 to 35 feet, neaps 21 to 25 feet. Neaps range 9 to 17 feet. Remarks concerning diurnal inequality of times and heights at Gogha, apply also to Bhaunagar.

Rhuk bank, the south extreme of which lies 1¾ miles E.N.E. from Bhaunagar light, extends thence in a northerly direction for a distance of 10½ miles to abreast Bauliari creek; the bank is partially covered at high water springs, and overgrown with mangrove bushes. A mud flat, dry at low water, extends 1½ miles in a southerly direction from the south end of this bank, and considerably narrows the channel leading to Bhaunagar creek.

A bell buoy is moored on the west side, near the south end of Rhuk mud flat.

Central banks.—On the east side of Bhaunagar channel there are several sand and mud banks which dry at low water; the westernmost of these, named Channel bank, is 2½ miles long N.N.W. and S.S.E. and over half a mile across; it dries 10 feet in some parts and is covered with grass. At 3½ miles east of Channel bank lies Southern patch, which dries 3 feet at low water. The summit of the Kokra hills in line with the large peaked tree at Gogha, leads southward of these shoals.

See plan, Piram island to Bhaunagar, No. 1,035.

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THE COAST from Bhaunagar creek trends in a northerly direction for 25 miles to East cape, the south-west point of the estuary of Sabarmati river, and is composed chiefly of mangrove jungle which extends several miles inland. At the head of Cambay gulf the banks are continually changing, and on the western shore the flats south of East cape dry off from the shore for about three miles.

Dholera, situated at the head of the gulf of Cambay, on the west shore of Sabarmati river, is the town from which the cotton grown in the surrounding country is exported to Bombay. Owing to the continued silting up of the Sabarmati estuary, the shipping port is now (1886) at Whittle bandar, about 1½ miles north-west of East cape; this place is connected with the town of Dholera by a road passing through the village of Rahtalao. Native craft lie alongside the bank to load or discharge cargo.

LIGHTS.—Dholera (Chilkari) lighthouse, situated on the west bank of Sabarmati river near East cape, about 2 miles south of Chilkari creek and about half a mile inland, is a wooden structure, conical in shape with two small sheds at its base, the whole painted black. The light is *fixed white*, elevated 45 feet above high water, and should be seen in clear weather from a distance of 12 miles, between the bearings of N. 84° E., through west, to S. 20° E. It is shown from 1st September to 31st May. From the falling away of the foreshore the position of this light has of late years been several times altered. At Whittle bandar a *fixed white* light is exhibited at an elevation of 20 feet, and should be seen about 2 miles.

THE BORE is a rapidly flowing tide-wave, forced through a narrow passage, over the remains of the ebb tide, the counter-action of which helps to give the wall-like aspect of the Bore.

The Eastern or principal Bore rises about 11 miles south-west from Cambay town, and is not perceptible on the neap tides, unless the previous springs have been very high, when it may be noticed slightly through the quarter. On the approach of the springs it plainly shows itself, increasing in height and velocity until two days after new or full moon, when it declines.

When new moon coincides with *perigee*, and the full moon with *apogee*, the highest tides are said to occur. The Bore varies with the night and day tide, the former being 6 to 8 feet higher than the latter, between September and April; and as the flood stream of both night and day runs for the same length of time, about 3 hours, the highest, or the night-tide

See chart, No. 51.

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in the fine season, and day-tide in the rainy season, must have the greatest velocity.

In January 1837, at very high springs, in Cambay creek, about 5 miles W.S.W. of the town, the Bore was observed 6 feet high, advancing at the rate of 10 knots an hour, with a loud noise, between the steep cliffs on the north and the sand-bank on the south, in a passage about 2½ cables broad. A quarter of an hour after the bore-wave had passed, the stream was found running at the rate of 4½ knots only; but, three-quarters of an hour after its passage, the flood stream attained the velocity of 8 knots, afterwards gradually declining; the ebb stream beginning 3 hours after the passage of the bore-wave.

The rise of the night tide in those three hours of flood was 31 feet, and the rate of its rise was as follows:—In the first ten minutes of flood-tide the water rose 6 feet; in the first hour, 18½ feet; in the second hour, 8½ feet; and in the third hour, only 4 feet.

From the above position where these facts were noted, the Bore rushed onwards to within 3 miles of Cambay; then, deflected by a sand-bank, the principal stream turned south-east towards Kevibandar, thence north-eastward to Dehvan, on Mahi river; the lesser stream moving on past Cambay town and losing itself over the banks.

The day tide at the same position only rose 23 feet. The ebb tides run steady, but do not acquire their greatest velocity, which is about 7 knots, until more than half-tide, when the high banks are uncovered, and the stream is confined to its narrow channel.

Off the village of Dehvan, on January 10th, 1837, the Bore was observed 7 feet high, with an initial velocity of 10 knots; but, after the wave's passage, the speed was reduced to 5 knots, increasing again to 7 knots three-quarters of an hour afterwards, when it gradually got weaker till the ebb made.

The Western Bore, which runs up the Sabarmati, is similar to the Eastern, but of less elevation and force; both, however, tend to alter the banks and channels, the navigation, therefore, should not be attempted without local knowledge. On the west bank of the Sabarmati, between Amli point and Dholera lighthouse, the surveyors in 1837 found that a bank 3½ to 6½ cables in width, and 5 miles long, had disappeared in one year.

The above description of the Bore shows that the flood tide comes with a sudden burst at great velocity; then, decreasing in strength for a time, attains its full strength about three-quarters of an hour after the passage of the bore-wave. The stream afterwards never attains the same velocity as the wave of the bore.

See chart, No. 51.

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NAVIGATION of the GULF.—With the exception of Mal bank, and the detached shoals off its south end, extending nearly 8 miles east of Gogha, the gulf is tolerably clear of dangers, and may be navigated without difficulty as far north as Gogha; beyond this it is not advisable to proceed without a native pilot, who can be obtained at Surat or Gogha. Should a vessel be detained in Surat road until the south-west monsoon has set in, it will be found very difficult to get to the southward round the foul ground off Dahanu or St. John, as a heavy swell sets in upon the shore, rendering it very troublesome to get an offing; and, at the commencement of the monsoon, the wind is much from the southward. It is therefore necessary, if bound to Bombay, or any other port in the southern or eastern parts of India, to proceed northward for Gogha, where supplies may be obtained, thence work along the west side of the gulf to Goapnath point, and on to Diu head; when a vessel may then stretch off the land, and can reach Bombay without tacking.

A vessel leaving Surat road, or when driven from it by south-west winds setting in strong, ought, with the last of the flood, to steer about N.N.W., keeping midway between Suwali bank and the head of Malacca banks, until through Sutherland channel. Dandi light should not be approached within 7 miles, nor Tapti light brought to bear southward of S.E.

If bound for Gogha, when westward of Gulwala bank, steer to pass about 2 or 3 miles eastward of Piram island, which should not be approached under 14 fathoms. When the vessel is northward of the hard ground off Piram, or with Gogha town bearing W. by N. ½ N., steer for the anchorage in 5 to 10 fathoms, at low water, abreast Gogha town.

Leaving Gogha road with the ebb, care is necessary to prevent being set down on the reef off Piram, or between that island and the western shore, where the tide usually runs 7 or 8 knots and sometimes 10 knots an hour in the narrow channel among the rocks, through which there is no safe passage for a vessel.

If not intending to run for Gogha, a vessel may with the last of the flood, if the weather become favourable, stretch across the gulf northward of the Malacca banks for the coast about Sultanpur, where anchorage may be obtained in smooth water northward of the bank abreast Satrunji river, taking care not to bring Talaja hill to bear northward of W. ½ N. The coast between Piram island and Sultanpur shoal is safe to approach into 8 or 9 fathoms, but in some places shoals very quickly from these depths. If enough ebb remains, or with the next ebb, a vessel may work southward round Goapnath reef and point, thence westward through Grant channel, and along the coast to Diu.

To work from Goapnath point, or from Gogha to Diu head, after the south-west monsoon has commenced, may not be always practicable, when

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See chart, No. 51.

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the wind hangs to southward; the moonlight nights are considered most favourable, the winds being then not so violent in general, as during the spring tides at the change of the moon.

A vessel bound to Bombay, or other parts of India, should sail from Gogha road at high water, and steer round the north-east part of the hard ground off Piram; thence work southward with the ebb, not shoaling into less than 7 or 8 fathoms towards the Kathiawar shore. The northern part of Sultanpur shoal is very dangerous for vessels working on the ebb, as the water is very deep, 15 to 20 fathoms, quite close to the shoal.

When round Goapnath shoal, every advantage of the tides should be taken, by anchoring when they are unfavourable, and keeping near the coast in working along, observing, as noticed in the description of this coast (page 241), that the soundings give little or no warning of the approach toward the shore, there being 8 and 9 fathoms close to it in some places, and the same depth 10 or 12 miles off. When near Salbet island, or near Jáfarábád, longer tacks off shore may be made occasionally, the ship being then to westward of the south-west extremity of Malacca banks; but it will be advisable to continue to work within a reasonable distance of the coast, keeping near it until abreast Diu head.

Having worked as far westward as Diu head, stretch out from the land with the ebb tide, and, if the wind inclines from the westward, a vessel will probably get into the latitude of the entrance of Bombay harbour, at a considerable distance from it, without tacking; but, if the wind inclines to S.S.W. or south-west, it will be advisable to tack occasionally to preserve the westing.

Care is necessary not to approach near the coast northward of Bombay harbour, as it would be very difficult in bad weather to work to the southward round the reef, against the heavy sea and drain of current setting along shore, especially at the beginning of the monsoon, and during the flood tide. Well out from the land, the sea runs more regularly, and advantage can be taken to tack with favourable squalls, or shifts of wind.

In crossing the entrance of the gulf of Cambay from Diu to Bombay, the 20-fathoms contour-line of soundings extends from Diu to the offing by Bombay, and a vessel should not shoal under that depth during the south-west monsoon until some of the Bombay landmarks are seen, or until in the latitude of Kundari island.

See chart, No. 51.

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CHAPTER VII.

KATHIAWAR AND OKHAMANDAL COAST.—GOAPNATH POINT TO BEIT ISLAND.

(Long. 72° 10′ E. to long. 68° 55′ E.)

VARIATION 0° 45′ E. in 1900.

The COAST of KATHIAWAR, from Goapnath point to the entrance of the gulf of Kutch, a distance of 230 miles, is composed chiefly of sandstone, with perpendicular cliffs and overhanging rocks in many parts. The surface of the country is undulating, and along the seaboard averages about 100 feet in height. The Gir hills, situated about 20 miles northward of Diu head, extend nearly 40 miles in an east and west direction, averaging 1,000 feet in height. This range is not visible any distance off the south-west coast, though Nandivelo, its south-east peak, 1,735 feet above the sea, is conspicuous from the southward.

Girnar mountain, 3,662 feet high, situated 35 miles inland, and 20 miles north-west of the Gir range, is of a conical form, and may be seen in clear weather from a distance of 60 miles, or along the coast from abreast Diu head to Porbandar; north of this it is obscured by the Barda range. Girnar mountain is an immense bare and isolated granite rock, upon which are numerous temples and monastic establishments of the Jains, which are amongst the most interesting architectural works in India.

Janjmeer, lying 3 miles westward of Goapnath point, is a walled town with the remains of an old fort, formerly a notorious piratical place; as was also Rajpur, midway between Janjmeer and Goapnath point. There is a small rocky islet, about 1¼ miles west of Janjmeer, connected to the shore by rocks at low water.

Maitlah point, 7 miles south-west of Goapnath point, is a low rocky projection, having to the westward a sandy bay and low shore, but rising to the north, till at a distance of half a mile it attains the average elevation of the undulating Goapnath land, rather more than 100 feet. There is a small creek on the west side of the point, only available for boats towards

See chart, No. 50.

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high water and during easterly winds; Maitlah village is 1½ miles north of the point.

Kutrah bluff, high and facing eastward, lies 2 miles W.S.W. from Maitlah point, and forms the west side of the intervening sandy bay. During westerly winds, boats can land on the north side of this bluff point.

Nikol Bandar, a small indentation in the coast, situated 8 miles west of Kutrah bluff, forms the entrance to a large extent of marshy ground which is overflowed at high water; this entrance is almost closed at low water by a ridge of rocks, extending nearly across. Small pattamars only frequent this bandar, finding their way by a creek to Nikol, and to Wagnugga, a village about 2½ miles from the sea.

Kutpur (Jegri) island, at 3 miles south-west of Nikol bandar, is 1¾ miles long east and west, and three-quarters of a mile across the broadest part; its south and east sides are bold rocky cliffs fronted by a reef that dries at low water for a distance of 2 cables; its western part consists of sand-hills 20 to 40 feet high. On the island, which is sparsely cultivated, there is a well near the east, and another near the west end; the water from the latter is excellent, but the supply is scanty.

LIGHT.—On Kutpur bluff stands a light-keeper's house, having on the flat roof a lantern, from which is exhibited, at an elevation of 90 feet above high water, a *fixed white* light, visible in clear weather from a distance of 13 miles.

Reef.—A reef, dry at low water, extends 2 cables eastward of Kutpur bluff, the east extreme of the island; around this reef the tides set with great rapidity forming a race.

Kutpur bay, on the north-east side of Kutpur island, is a large but shallow bay, the mud bank drying at low water, for three-quarters of a mile from the shore. Small vessels might find shelter from westerly winds, immediately off the east side of Kutpur island (bottom mud).

The depths generally increase gradually from the shore, but eastward of the lighthouse are some rocky patches; the least water found, 3 fathoms, bears E. by N. ¾ N., 8½ cables distant from the lighthouse.

Kutpur village, in the depth of the bay, is an inconsiderable place of about 250 houses. No supplies are obtainable, but excellent water will be found in some wells near a very large banian tree just north of the village; this banian tree, together with a small temple on the summit of a sand-hill, about three-quarters of a mile north-east of Kutpur, are the most conspicuous marks from seaward on this part of the coast.

See chart, No. 50.

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MAHUWA BAY, situated on the west side of Kutpur island, is about one mile in extent east and west, and half a mile deep; nearly the whole of it is dry at low water, showing a mass of rocks and stones. The land on both sides of the entrance is bluff, and from the west entrance point a reef, which dries at low water, extends to the eastward $2\frac{1}{3}$ cables, on the extreme of which lies Dosi rock, 4 feet above high water; the north extreme of this reef is marked by a beacon. Midway between Dosi rock and the east entrance point there are two rocks, awash at low-water springs. Pattamars sometimes anchor south of the east entrance point when waiting for high water to proceed to the bandar.

Mahuwa Bandar, situated north-west of Kutpur island, is approached from the bay by a small creek, which nearly dries at low water, and is distant from the entrance about one mile. The bandar is connected to the town of Mahuwa by a raised road, and has two or three small sheds on it, and a custom house. Craft frequenting it ground at low water.

Mahuwa town, in Bhaunagar territory, is situated about 3 miles north of Kutpur island, from which it is separated by an extensive swamp, overflowed at high water. It is a walled town containing 3,000 houses, with a population in 1881 of 13,704; it is connected by good roads to the interior, and at present commands some of the trade of the province of Kathiawar. Near the centre of the town is a large Jain temple, the top of which can be seen from a considerable distance; without the walls are a travellers' bungalow, vernacular school, and cotton press. Mahuwa is the headquarters of the chief revenue officer of the district. To the south and east of the town is an extensive plantation of over 340,000 trees (half of which are cocoa-nut) belonging to the Bhaunagar State.

Trade.—The principal export trade is with Bombay in cotton; grain, wool, and ghi are also exported, and a miscellaneous trade is carried on with the Persian gulf and Aden. The chief articles imported are grain, seeds, dry fruit, sugar cane, piece goods, yarn, and timber.

Supplies.—The population of Mahuwa being composed almost exclusively of Hindus, all food supplies, with the exception of grain, ghi, milk, and eggs, are difficult to procure.

Communication.—The nearest railway and telegraph stations to Mahuwa are at Bhaunagar, distant by road 60 miles, but there is a daily post service. Coasting steam vessels call in at Kutpur bay occasionally during the north-east monsoon, on their way from Jáfarábád to Bhaunagar.

Tides.—It is high water, full and change, at Mahuwa bandar at 2 h. 22 m.; springs rise $13\frac{1}{4}$ ft., neaps rise $9\frac{1}{2}$ ft. Mean springs range 12 ft. 6 in.; mean neaps range 5 ft. 7 in.

See plan of Mahuwa bandar, on chart, No. 50.

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South and west of Kutpur island the tidal streams set in the direction of the line of coast, the flood to the eastward and ebb to the westward, attaining at springs a velocity of 4 knots: off Kutpur bluff the flood stream sets more to the northward, but in the depth of Kutpur bay is little felt. Strong eddies and a race form to the south-east of Kutpur bluff, about the times of high and low water.

Winds.—At Mahuwa, during November, the winds are most frequently from the N.E. The wind gradually backs through north and west to south-west in June, veering again through west and north to north-east in November.

The following are the prevailing winds for the several months:—

Month.	Wind.	Month.	Wind.	Month.	Wind.
January -	N.E. to N.W. by W.	May -	W. to W.S.W.	September	S.W. to W.
February -	N.N.W. to W.S.W.	June -	S.W.	October -	W. to N.W.
March -	N.W. to W.	July -		November	W. to N.E.
April -		August -		December	N.N.W. to N.E.

The north winds in January are sometimes accompanied with very cloudy weather and showers. North-east winds blow in heavy squalls, raising a high sea in Kutpur bay.

Gadhara village, situated 2¼ miles westward of Mahuwa bay, stands on the edge of the cliff, 65 feet above the sea. The coast between is composed of limestone cliffs, fronted by a reef extending 1½ cables from the shore, with 5 to 6 fathoms water close-to, deepening suddenly to 7 and 8 fathoms, which depths will be found across to the Malacca banks.

Islet point, situated about 4 miles westward of Gadhara village, is a prominent hilly point, fronted by several islets. These islets are, at low water, all connected with each other and with the shore by a reef of rocks; the east extreme of this reef has a depth of 9 fathoms close-to, and lies about midway between the southern islet and the village of Gadhara, and 1¼ miles from the shore high-water mark. The southern islet is 80 feet high and steep-to, and on its west side lies Putwa bay, between 2 and 3 miles wide, which affords shelter for small craft from easterly winds.

Chanch Town, situated about 3½ miles westward of Putwa bay, stands on a projection named Chanch point, 97 feet high, midway along the sea-face of Chanch island. Chanch island is nearly 5 miles long east and west, and half a mile broad. There is an extensive mangrove swamp

See chart, No. 50.

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at the back of this island, covered only at very high springs. The island of Chanch is the western limit of the territory of the rajah of Bhaunagar.

SALBET ISLAND, situated 4¼ miles south-west of Chanch point, and 1½ miles from the mainland, has remains of old fortifications upon its north and east sides; it is a possession of the Nawab of Janjira.

The island is nearly triangular in form, three-quarters of a mile long on its south side, and little more than half a mile across the broadest part; its sides are composed of rocky cliffs 40 to 60 feet high, with the exception of a part of the east side and a small bay on the north-west, which are low and sandy. On the highest part of the island, 66 feet above the sea, and 2½ cables from its south-west point, is a station of the Great Trigonometrical Survey of India, in latitude 20° 54′ N., longitude 71° 30′ E.

On the north-west side of Salbet is a small village containing, during the period of the south-west monsoon, a population of between 500 and 600. During the north-east monsoon the island is almost denuded of its male population, who obtain employment as coolies in the adjacent territories. The island is but slightly cultivated, the greater part being covered with ruins of what must have been extensive buildings and fine temples; there are a few stunted trees and numerous wells of fresh water near its centre.

On the south and west sides of Salbet the shore reef dries one cable from the cliff, and is steep-to on the south side; but off the south-west point, shoal water extends 3 cables in a westerly direction. On the north side there are depths of 3 to 4 fathoms at less than a cable from the shore, while from the east side an extensive bank of sand and mud, which dries at low-water springs, extends to the eastward a distance of 8½ cables.

Sawhai Bet, a barren, rocky island, 63 feet high, 3½ cables long east and west, and one cable broad, is connected with the east extreme of Salbet island by a reef which dries at low water. Near the centre of Sawhai Bet, there is a Mohammedan tomb or pir (a small white-domed building), conspicuous from seaward, which forms a good landmark.

Sawhai reef, situated one cable east of Sawhai Bet island, dries at half tide, and extends 2½ cables to the eastward, having depths of 6 to 10 fathoms within a distance of one cable.

Abusalia.—A bluff rocky islet 61 feet high, situated 1¾ miles east of the north extreme of Salbet, is steep-to on its east side, there being 5 fathoms water at less than half a cable, but from its west end a ledge, which dries at low water, extends 1½ cables to the north-west.

Dangers.—Sims rock, awash at low-water springs, lies W. by S. 2½ cables from the west extreme of Abusalia.

See plan of Salbet, on chart, No. 50.

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Eastern channel patch, rocky, and with but 6 feet water over it at low water, lies 6½ cables N.W. from the west end of Abusalia islet.

The spit, which extends about 1¾ miles from Chanch island in a south-west direction, has generally from 2 to 5 feet over it, but near its extremity there is a bank of hard sand and shells, 1½ cables in extent north and south, 3½ cables east and west, which dries one foot. The tail of the spit lies N.N.W. ¾ W., 5½ cables from the north extreme of Salbet island.

Anchorage.—There is good anchorage between the spit and the north side of Salbet, in 3 to 6 fathoms, bottom sand and mud, where vessels lay sheltered from the south-west monsoon. For a vessel of about 18 feet draught a good berth is with the north extreme of Salbet bearing south 2 to 3 cables distant.

Pattamars waiting for the tide to proceed up Mota pat creek generally anchor northward of Abusalia in 2 to 3 fathoms, mud bottom, where the tide stream is but little felt.

DIRECTIONS.—West channel.—The west channel to Salbet anchorage, between Salbet and the mainland, is narrowed to about 2½ cables by the fringing reefs. The best time for entering is at low water, when the west reef which is steep-to is visible; its outer danger (Square rock) uncovers, 3 feet. To enter by this channel, which has 5 fathoms water, steer for a ruined hut on a small hill at the head of the bay on the bearing N. by E. ¾ E., until Chacuda temple (on a bluff at the entrance to the Dhantravari river and conspicuous) bears W. by N. ½ N., when steer for the single tree on One tree hill at the west extreme of Chanch island N.E. ¾ N., and when the whole of Abusalia is open north of Salbet anchor as convenient.

East channel between Abusalia and Chanch.—Steer to bring Chacuda temple W. by S. ½ S. before Abusalia bears South, and keep it on this bearing until North of the east extreme of Salbet, when the Eastern channel patch will have been passed and a vessel may haul to the southward to anchor as before. To keep in not less than 2¼ fathoms in this channel at low water, the above bearing of Chacuda temple must be very carefully preserved.

Mota pat or Chanch creek, on the west of Chanch island, is the outlet for waters which cover an immense tract of marshy land at high water. It is fed by numerous small creeks, the principal of which, Devrapura creek, admits small pattamars to Bherai and Pipalwao Bandars.

About 2 miles within the Mota pat creek lies Kathiwadar Bandar the port of Dongar, the principal town on this part of the coast, to which it is contemplated to bring a branch of the Bhaunagar-Gondal railway, for the

See plan of Salbet, on chart, No. 50.

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purpose of opening up the cotton districts, and to form a shipping port. Dongar has a population of 2,730.

Kathiawadar Bandar is connected to the mainland by a road 3 miles long, built across the intervening marshy ground. Only small vessels can proceed to the bandar, as there is but 7 feet in the channel thereto at low water.

Trade.—At Kathiwadar Bandar the value of exports (principally cotton) is Rs. 135,000, and imports Rs. 1,000,000 annually; all the trade is carried on by native craft. No supplies can be obtained.

Water.—Good water may be procured from a small well on Sawhai Bet; the water on Salbet is slightly brackish.

Communication.—The nearest railway and telegraph station to Salbet is distant 60 miles, and the nearest post office (Bherai) 5 miles.

Tides.—It is high water, full and change, at Salbet at 1 h. 48 m.; springs rise $10\frac{3}{4}$ feet; neaps $7\frac{1}{4}$ feet. Mean neaps range 3 feet.

The ebb stream from off Chanch sets south-west and divides north of Abusalia into two streams, one setting to the westward through Salbet anchorage and the west channel, attaining at springs a velocity of $2\frac{1}{2}$ and at neaps one knot; the other stream passing outside Abusalia, sets towards Sawhai Bet reef and then west along the line of coast, at a velocity of 3 to 4 knots at springs, and of $1\frac{1}{2}$ to 2 knots at neaps.

The flood sets across the entrance of the west channel and branches off, one stream running through the channel, fair through the anchorage and thence north-east to Chanch at the rate of 2 to 3 knots at springs, and about one knot at neaps. The other branch sets E.N.E. past Sawhai Bet reef and thence to Abusalia, with a velocity of 3 to 4 knots at springs, and 2 to 3 knots at neaps; strong eddies form in the west channel at high and low water.

Reef.—At a distance of three miles south-west of Salbet island, a flat reef which uncovers about 5 feet at low-water springs extends $3\frac{1}{2}$ cables from the shore, having on it an islet 15 feet above high water. The coast thence to the westward is cliffy, the points being quite precipitous. The ground at the back of the cliffs is undulating and partly cultivated; most of the hill tops on the coast have small watch towers about 6 feet high.

JAFARÁBÁD HARBOUR, at $7\frac{1}{2}$ miles west of Salbet, is very shallow, but affords good shelter for small coasting vessels by which it is frequently used during the south-west monsoon. A reef of flat rock extends half a mile from the east side of the harbour, but within the bottom is soft mud. At the head of the harbour there is a creek, about

See chart, No. 50; also plan of Jáfarábád harbour, No. 1,779.

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150 yards wide, running in a north-west and northerly direction through flat swampy ground which is overflowed at high-water spring tides.

The town of Jáfarábád is on rising ground near the south end of the creek, and about one mile from the entrance to the harbour. It is a walled town with several round towers, with a flagstaff on the highest, from which a large red flag is flown on Fridays. The town can be seen from the southward and eastward, showing over the intervening high ground. It belongs to the Nawab of Janjira, on the coast of South Konkan, and is governed by a Mamlatdar. This territory, including about twelve villages, east and west of Jáfarábád, possesses (1891) a population of 12,389; in 1881 it had 9,405. The population of the town of Jáfarábád in 1881 was 4,746.

LIGHTS.—From a white masonry tower 50 feet in height, on the west point of Jáfarábád harbour entrance, is exhibited a *flashing white* light *every twenty seconds* at an elevation of 85 feet above high water, which can be seen in clear weather from a distance of 15 miles.

A *white* light is also exhibited from a small tower, about 20 feet above high water, situated on the quay at the north-east extreme of the town and overlooking the creek, but it is only visible about 2 miles.

Anchorage.—Good anchorage in fine weather will be found off the harbour in 7½ fathoms, soft mud, with the lighthouse bearing W. by S., and Dark point N. by E. At this position the town light tower is in line with Quarry point.

Tides.—It is high water, full of change, at Jáfarábád at 1 h. 48 m.; springs rise 10½ feet, neaps 7 feet, neaps range 2½ feet.

In the months of March and April the night tides are higher than the day, the rise of high water differing from one to 2 feet, and the level at low water sometimes as much as 3 feet, the day low water being lower than the night. There is not much diurnal inequality in the times of high and low water. The tides are regular at neaps, the day high water being sometimes scarcely perceptible, the water only rising a few inches in an hour or so, and then continuing to fall.

Outside the harbour the flood stream runs to the eastward, parallel to the coast, and the ebb to the westward. At springs the flood stream continues one hour after high water by the shore, and the ebb 2 hours after low water; both attain a maximum strength of 3 knots after running three hours.

At neaps the flood stream runs for half an hour after high water and the ebb till 1½ hours after low water, maximum strength of flood 1¾ knots, and of ebb 1½ knots.

At neaps the ebb stream changes to flood, in the direction of the hands of a watch, and the flood to ebb, in a contrary direction.

See plan of Jáfarábád harbour, No. 1,779.

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Supplies.—Vegetables and a small quantity of poultry only can be procured. Good water can be obtained easily from a well near Datum point. There is no coal, and firewood is scarce.

Communication.—From the middle of October to the middle of May, the small steam vessels of the Bombay S. N. Co. (Shepherd & Co.) call at Jáfarábád once a week from Bombay and Bhaunagar, and return to Bombay direct. Communication with the interior is difficult owing to the nature of the country, which detracts from the usefulness of the port. There is a post office, and telegrams are received and sent with the letters once a day by runner to Mahuwa, taking about 8 hours on the journey.

NANDIVELO MOUNTAIN, 1,735 feet above the sea, the south-east peak of the Gir Hills, lies 18 miles north-west of Jáfarábád and is conspicuous from seaward. About 10 miles north-east of this mountain there is another named Dhua-ke dongur, or Smoke-hill, only seen in clear weather; eastward of this the country is hilly as far as Mahuwa. Between Jáfarábád and Nandivelo, there are two hills more conspicuous than the others, Conical hill, 345 feet high, at 7½ miles north-west of the harbour; and Round hill, 486 feet high, at three miles West of Conical hill.

Murex reef, which uncovers 6 to 9 feet at low water, lies 5 miles West of Jáfarábád harbour and extends half a mile from the coast. Shoal water extends 1½ cables from the edge of the reef, but outside that there are depths of 9 fathoms.

The summit of Murex bluff is 78 feet high, and at one mile west of this, is the boundary between the state of Junagarh and Jáfarábád territory.

Rajpur, a village on a point which forms the west side of a small bay, lies five miles west of Murex bluff, and has high ground with steep cliffs to the westward of it.

Bainsla islet, 2½ miles south-west of Rajpur and lying a mile from the shore, is composed of rock, and is apparently connected to the mainland by a reef of rocks extending towards Semah point more than one mile to the westward of it. To the north-west of this islet the shore forms a deep bight, over which the sea flows at high spring tides.

Semah fort, situated on a point 1¼ miles west of Bainsla islet, belongs to the Portuguese, by whom it is garrisoned. From the sea it appears as a flat-topped white house, with a flagstaff. Semah point is the eastern end of a range of cliffs 2 miles long, the west extreme of which appears as a sharp bluff when seen from the eastward.

Nawabandar.—At 1¾ miles west of Semah fort the coast recedes and forms a shallow bay 2½ miles wide, on the west side of which stands the small town of Nawabandar, on the right bank of a creek of the same

See chart, No. 50.

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name. This creek is available for small coasters towards high water, and its mouth is partially protected from west winds by a reef projecting 3 cables eastward from the entrance point. All these small bays, on the east side of points, which formerly afforded some shelter, are gradually filling up, owing to the action of the monsoon waves on the cliffs.

Nawabandar, formerly a resort of pirates, belongs to the nawab of Junagarh. At 2 miles north of Nawabandar there are some conspicuous brab trees, and at 1¼ miles west of these trees stands the town of Dilwara, with a large temple.

A shoal with 6 feet least water and 10 fathoms close to its south edge, extends half a mile in an easterly direction from Nawabandar point. For 2 miles west of this point the shore is high, with deep water close to.

The Mohammedan seamen of Nawabandar and Gogla are considered to be the best sailors of Hindustan.

Light.—On a rock adjoining the shore south of the creek at Nawabandar, a *fixed white* light is exhibited between September 1st and June 30th.

DIU ISLAND, situated 5 miles west of Nawabandar, belongs to Portugal; it is 7 miles long east and west, nearly 2 miles across at the broadest part, and is separated from the mainland by a narrow boat channel, which runs through the middle of a large swamp. The sea-face of the island is composed chiefly of sandstone cliffs; the hills on its western part are about 100 feet high.

Diu fortress and castle, situated at the eastern extreme of the island, presents an imposing appearance from the sea.

Diu town lies a short distance west of the fortress, and contains two Mohammedan mosques, and many small Hindu temples. The place has greatly declined in prosperity, and is now of little commercial importance.

Fishing is the chief occupation of the inhabitants, some of whom find temporary employment at Mozambique.

Population.—The population of Diu island in 1891 amounted to 12,758; it was said formerly to contain 50,000 inhabitants.

Abreast Diu town, on the north side of the boat channel, stands the Portuguese village of Gogla, from which a sandy spit extends nearly half a mile in an easterly direction. On the south-east extreme of this spit there is a small fort, named Forte de Mar, or Islet fort; and at a short distance, north-east of the village, another fort named Gogla.

Light.—From a column on the tower of Forte de Mar, is exhibited a *fixed red* light, which should be seen in clear weather from a distance of 3 miles.

See chart, No. 50; also plan of Diu harbour, on chart, No. 2,736.

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Diu harbour, where there is anchorage in 3 to 4 fathoms, water, lies eastward of Gogla village; the channel to it lies between a shoal with 6 feet least water, at 9 cables E. ½ S. from Islet fort; and another shoal having 12 feet water, the west end of which lies $1\frac{6}{10}$ miles E.S.E. from Gogla fort. Steer for the anchorage with Gogla fort bearing N.W. by W. ½ W., until the fortress east point bears S.W. ½ W., when anchor. Small vessels may enter the creek, and anchor in from 6 to 15 feet; this part of the harbour is protected from southerly winds by a reef extending eastward nearly half a mile from the fortress. Vessels should not anchor in Diu harbour in strong easterly winds; the holding ground, sand and rock, is irregular and indifferent.

Supplies.—Diu is an indifferent place for supplies; no meat, and but few vegetables, are procurable; salt fish and rice are plentiful. Poultry may be obtained at Gogla.

Water.—Good water is supplied to shipping on application to the governor. It is stored in ancient tanks, formed in the solid rock, which are filled every rainy season; pipes lead from these tanks to the castle bandar, where small vessels may lie to receive it.

Tides.—It is high water, full and change, at Diu harbour at 11 h. 0 m.; ordinary springs rise 6 feet, neaps rise 4½ feet. The flood stream outside Diu sets E. by N., greatest velocity at springs 1½ knots; it often runs for 2 hours after high water by the shore. The ebb sets W. by S., 2 knots at springs, and often runs for 2½ hours after the water along the shore has begun to rise. These irregularities of tides will account in some measure for the eddy currents off Diu head.

At the end of January 1836, for two or three days before full moon, the stream, in the offing between Nawabandar and Diu, ran to the westward, at the rate of less than one knot, for 18 hours consecutively; the flood during those days was scarcely perceptible.

Nagwa village and fort, at 4¾ miles west of Diu fortress, is situated in a small bay, about half a mile within the west entrance point, from which the cliffy shore extends about 1¼ miles to Nagwa point. This bay affords shelter to small vessels from westerly winds.

Nagwa point is a dark bluff nearly 100 feet high, and has on it the highest palm tree in the vicinity. Foul ground, over which the sea breaks, extends 2 cables west of the point.

Bara fort, commanding the west entrance of the boat channel inside Diu island, stands 1½ miles west of Nagwa point; this entrance is fronted with several scattered rocks.

See chart, No. 50; also plan of Diu harbour, on chart, No. 2,736.

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Rocky shoal.—The outer danger, named Rocky shoal, on which the sea breaks, has but 9 feet upon it at low water, and lies nearly 1½ miles S.W. by S. from Bara fort; the shoal is nearly a mile long east and west, and about a quarter of a mile across, with 5 to 6 fathoms close around.

Anchorage may be obtained in 8 or 9 fathoms water, with Nagwa point bearing N.E., distant about three-quarters of a mile; the holding ground at this anchorage is good, but there is little shelter.

MANDWA BAY.—Between Nagwa point and Diu head at 4 miles west of it, the coast recedes and forms a bight, in the western part of which lies Mandwa bay, about one mile deep, with soundings of 3 to 6 fathoms, decreasing gradually towards the shore.

Diu head is a bluff, rocky projection, about 100 feet high, and may be recognised by the lighthouse and a small temple standing on the summit, from which it slopes in an easterly direction and terminates in a rocky point. At 1½ cables east of this point there is a rock 8 feet high, named Mandwa Bainsla, having foul ground on which the sea breaks heavily, extending 3½ cables to the eastward.

Mandwa creek, the entrance to which dries at low water, lies about half a mile north-west of Mandwa Bainsla rock; within the creek there are depths of 6 to 10 feet at high-water springs. The shore along the head of Mandwa bay, for a distance of 1¾ miles east of the creek, is composed of low sand-hills, ending in a rocky point at the entrance of Brancawara creek; just north of these sand-hills, and about one mile west of this point, there is a tall brab or palm tree which is conspicuous from seaward.

The country in the immediate vicinity of Mandwa bay, consists chiefly of mud flats, which are partly covered at high-water springs.

Mandwa bay affords shelter from north-westerly winds, and the holding ground is good, but there is frequently a swell setting into it, and with southerly or easterly winds the anchorage should not be used.

Directions.—Proceeding for the anchorage in Mandwa bay, steer with the conspicuous brab tree, in line with the easternmost small sharp peak of distant range of hills, bearing N. ⅝ E., until the palms, 1½ miles north-west of Diu head, are in line with the yellow cliffs at the entrance of Mandwa creek, W. by N. ½ N., when a vessel may anchor in 6 fathoms, mud.

Tides.—It is high water, at full and change, in Mandwa bay at noon; springs rise 8 feet, neaps 6 feet. There is a considerable inequality both in heights and times. The tidal movement is at times very weak, and the rise and fall scarcely perceptible at neaps.

See plan of Mandwa bay, on chart, No. 50.

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LIGHT.—On Diu headland near Mandwa temple there is a white hexagonal lighthouse, 32 feet high, from which, at an elevation of 106 feet above high water, is exhibited a *flashing white* light every *ten seconds*, visible in clear weather from a distance of 14 miles.

Position.—Latitude 20° 41′ N., longitude 70° 50′ E.

Shoal bank, with its east end situated 1½ miles west of Diu head, is a rocky shoal upwards of 6 miles in length, about half a mile broad, and distant from the shore, to which it lies parallel, 1½ miles.

The least water on this shoal is 12 feet, and there is deep water between it and the shore. No vessel should approach it within 13 fathoms, which depth is about one mile from its outer edge. The lighthouse on Diu head, bearing E. by N., leads southward; Mul Dwarka N.N.W. ½ W. leads westward of the bank.

Mul Dwarka.—From Diu head, the coast trends in a north-westerly direction, 10 miles to Mul Dwarka, the intervening coast forming rocky points with sandy bays between, and some cliffs of 30 to 40 feet elevation. Mul Dwarka is a small bluff point with an old temple on its summit, 78 feet above the sea level, and may be known by the white sand on the top of the cliffs and the dark building of the temple; there is a single brab tree a short distance to the north-west.

There is a good landing place for boats on the south-east side of the headland on which the temple is situated. About half a mile east of Mul Dwarka, Singaora river falls into the sea; this river has very little water in it except during the rains. There is also a large salt creek, called Samod, about 1½ miles west of Mul Dwarka.

The town of Korinar is just visible amongst trees, 3 miles north-east of Mul Dwarka; and a white tomb stands close to the sea, 2 miles eastward. The village of Chara, east of the tomb, has larger and thicker trees than elsewhere. Mul Dwarka, and the coast eastward, up to Diu, is under the dominion of the Gaekwar; but westward as far as Shilbandar the country is under the Nawab of Junagarh.

Tides.—It is high water, full and change, at Mul Dwarka, at about 10 h. 30 m.; springs rise 7 feet. Between Diu head and Sutrapara the ebb sets W.N.W. and flood E.S.E. about one to 1½ knots per hour, but subject to irregularities and checks from prevailing currents. In December and January, with the current setting up the coast, the ebb has often been observed to run for 12 hours at a time, remaining slack during the time of flood generally, but with a slight set to eastward occasionally.

Sutrapara, 11 miles north-west from Mul Dwarka, is a small bay affording anchorage for coasting craft, being somewhat protected by a spit on either side; the bandar is a good landing place for boats. On

See chart, No. 1,420.

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the north side of the bay there are cliffs about 50 feet high, and on the south side high sand-hills; the town of Sutrapara stands about half a mile inland. The shore reef projects a little off the south point, and has upon it two large rocks.

The coast between Mul Dwarka and Sutrapara is low and sandy, with patches of cliffs at intervals. Dhamlej, situated half a mile inland, lies 3 miles west of Mul Dwarka.

Soundings.—The soundings are regular over a muddy bottom until within one mile of the shore, where it becomes rocky. The depths are 12 fathoms at 2 miles, 15 fathoms at 5 miles, and the 20-fathoms contour-line runs at about 10 miles from the shore.

VERÁVAL, a large town situated on the coast 8 miles north-westward of Sutrapara, shows up well from seaward, as many of the houses rise abruptly from the surrounding country. The custom-house, a large white building facing the sea, is the most conspicuous.

LIGHT.—From the pier head at the south extreme of Verával, a *fixed white* light, elevated 56 feet above the level of high water, is shown, which is visible in clear weather from a distance of 10 miles, but can only be seen 6 or 8 miles in the south-west monsoon. The lighthouse is a white octagonal stone tower, 40 feet in height.

Boat harbour.—To the east of the lighthouse is a shallow boat harbour, partially protected by a rocky spit and reef extending 3 cables south-eastward from the pier; it is generally crowded with native craft in the fine season.

Oata shoal, in the boat harbour, is marked by an iron buoy painted red, which lies 2 cables east-south-east from the lighthouse; and at about 1¼ cables north of it, is a wooden buoy painted white. These buoys are not in position during June, July, and August.

Two miles E.S.E. from Verával stands Patan, a town about the same size as the former place; it is surrounded by a wall of dark-coloured stone, within which are the ruins of the once famous temple of Somnath.

Anchorage.—Verával is quite an open roadstead, but fairly good anchorage in fine weather may be found in 10 fathoms with the lighthouse bearing N. ¾ W., distant 9 to 10 cables, and the left extreme of Patan walls E. by N. ½ N. The bottom is more even, and the holding ground better, a little farther out in 12 fathoms.

Tides.—It is high water, full and change, at Verával at 10 h. 27 m.; springs rise 9 feet, neaps 7½ feet, neaps range 3 feet.

There is no perceptible tidal current in the roadstead, but there is sometimes a surface drift of about half a knot, depending on the wind.

See plan of Verával roads, No. 1,779.

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Population.—By the census of 1891 the population of Verával was 15,339, consisting chiefly of traders, cultivators, and fishermen.

Trade.—The imports are grain, chiefly millet, wheat, sesamum seeds, rice, timber, coir rope, and cotton seed. The exports are cotton, castor seeds, onions, firewood, and ghee. The values of the imports and exports average each about 2,300,000 rupees per year.

Storm Signals.—For description, *see* page 56.

Supplies.—Water and wood are cheap and plentiful at Verával; the former being easily obtained from a well near the shore, east of the sandy bay to the east of the town. The wells to the west of the town contain brackish water. Rice and poultry are procurable, but no beef or mutton; vegetables are good and plentiful. There is no coal.

Communication.—Verával is now connected by railway with the capital Junagarh, and Bhaunagar.

The British India steamers, and Shepherd and Co.'s steamers, call here once a week on their way up and down the coast, but not during the months of June, July, and August, when the port is closed. There is a post and telegraph office in the town.

MANDAR, the bandar of Chorwar, situated 10 miles north-west of Verával, is a small anchorage, with an old tower and a storehouse close to the beach, the town stands 1½ miles northward of the bandar. A river, named the Megal, pours its waters into the sea during the south-west monsoon, about half a mile to the eastward; but, like most of the rivers on this coast, its mouth is generally dammed up with sand during the fine season.

The shore between Verával and Mandar is generally sandy, with low cliffs here and there, but the bottom below low-water mark is rocky, which renders landing difficult.

MANGROL BANDAR, situated 10 miles north-west of Mandar, is a small anchorage for boats, formed by a ledge of flat rock against the inner side of which three or four native vessels can lie; it is open to all winds except those from north-west and north-east.

The town of Mangrol lies 1¼ miles inland, and has a high tower which is conspicuous from a distance of 10 to 12 miles. Near this place there is much cultivation and many trees. The nawab is a Mohammedan, tributary to Junagarh.

LIGHT.—A *fixed white* light is shown at an elevation of 75 feet above high water, from a square house 400 yards from the landing place

See chart, No. 1,420.

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at Mangrol. The light should be visible in clear weather from a distance of 4 miles.

Tides.—It is high water, full and change, at Mangrol bandar, about 10 h. 30 m.; springs rise 7 feet, neaps 5 feet. About this place the streams of tide are not perceptible.

The Coast from Mangrol trends north-westerly to Navibandar, a distance of 27 miles. The soundings off it are regular over a muddy bottom, the 10-fathoms contour-line is distant about one mile from the shore, the 20-fathoms line 10 to 12 miles.

Shilbandar, 5½ miles north-west of Mangrol, has a creek in which there is sufficient water for native vessels, but the mouth is only open during rains. On the south entrance point stands a square tower on a high sandy mound; the town of Shil is about one mile within the creek. A single tree rises out of a copse of trees at the village of Miransha to the south-east of Shil tower.

Mahadeopur is a small walled town near the shore about 7 miles to the north-west of Shil. The beach is steep and sandy, but the landing difficult on account of the surf. There are high sand-hills south-east of Mahadeopur. At this place the territory of the Rana of Porbandar commences.

NAVIBANDAR is a walled town, 15 miles north-west from Mahadeopur, lying close to the sea, but it is three-quarters of a mile up the creek at the mouth of the Bhadar river. The river entrance is shallow, rocky, and difficult of access; dhows drawing 6 feet enter during the fine season. The population of Navibandar is about 1,100.

LIGHT.—From the sea-face wall of the centre bastion at Navibandar, at an elevation of 60 feet above high water, a *fixed white* light is exhibited, visible in clear weather from a distance of 5 miles. The light is shown from 15th September to 15th June.

Anchorage.—Good anchorage may be obtained in 5 fathoms, water, off the entrance to the creek, with a solitary building at 2 miles north-west of the town, in line with the centre peak of Barda hills, bearing N. ⅛ W., and the light tower E. ½ S.

Tides.—It is high water, full and change, at Navibandar, at about 10 h. 17 m.; springs rise 8 feet, neaps rise 6½ feet.

The Coast about, and to the north-westward of, Navibandar consists of sand-hills with patches of trees near the villages, at the back of which

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See chart, No. 1,420; also plan of Navibandar, No. 1,321.

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there is an extensive swamp where water-fowl abound. At Tunkra village, 5½ miles north-west of Navibandar, there is a conspicuous temple.

There is a depth of 5 fathoms water half a mile from the shore, off which the 10-fathoms contour-line is distant about 3 miles.

PORBANDAR,* the largest town on this coast, and a place of considerable trade, lies north-west, 15 miles from Navibandar; it contains (1891) a population of 18,805, and is connected by railway with the Indian system.

The Rana of Porbandar possesses the district of Barda, the sea-coast of which lies between Mahadeopur and Miani. He is subordinate to the Gaekwar of Baroda, to whom he pays tribute, as he does also to the Nawab of Junagarh, and to the British Government; the latter in addition receives a share of the customs duties of Porbandar.

The entrance to Porbandar creek, 3 cables west of the town, is narrow, and fronted by reefs which dry 5 feet at low water. The ebb runs very strong, and continues for some time after low water; great care is necessary, when leaving the creek on the ebb, to avoid being set on the reef abreast the entrance. When this reef is covered small vessels of 3 feet draught, and at high-water springs, those of 6 feet draught, can enter.

Imports.—The chief imports consist of rice, grain, and piece goods.

Exports consist of cotton, ghee, and stone for building, obtained from the Barda range.

LIGHT.—On the sea face of the town of Porbandar stands a circular white tower, 83 feet high, from which, at an elevation of 90 feet above high water, is exhibited a *fixed white* light, visible seaward from N. 49° W. to S. 49° E. The light in clear weather should be seen from a distance of 15 miles.

Position.—Latitude 21° 38′ N., longitude 69° 36′ E.

Tides.—It is high water, full and change, at Porbandar at 9 h. 36 m.; springs rise 8½ feet, neaps rise 6½ feet, neaps range 1½ feet. The tide in the creek runs from 1½ to 2 knots an hour. In the offing the tide streams are not perceptible; high water occurs here earlier than at any other part of the coast; the flood stream diverges hence to north and south.

Storm Signals.—For description *see* page 56.

Anchorage may be obtained in 5 fathoms, sand and rock, off Porbandar, with the lighthouse bearing N.N.E., and the Administrator's

* The *Pemba* reports having passed on 27th March 1896, a mast with a flag, apparently attached to a sunken buggalow, lying in a depth of about 18 fathoms, 10 miles south-south-westward of Porbandar, in approximately lat. 21° 29½′ N., long. 69° 30½′ E. *See* plan of Pobrandar, No. 1,321.

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house E. by N., or farther out as required. Small vessels anchor in 3½ to 4 fathoms water in a narrow pool about half a mile in length, from 1½ to 2 cables off the shore, south of the town.

During the fine season the passage to this anchorage is marked on the west side by a red bell buoy, with tripod and cage, and on the east side by a black buoy, with tripod and cage. A white stone beacon on the shore south of the town, in line with the north shoulder of the Barda hills, bearing N. by E. ¾ E., leads between these buoys in 13 feet water; when the lighthouse bears N.N.W. ½ W. steer for it and anchor as convenient.

Barda hills, situated 8 to 18 miles north-east of Porbandar, are visible in clear weather from seaward for a distance of 25 to 30 miles. The highest peak is 2,053 feet above the sea.

Miani, situated north-west 17 miles from Porbandar, is a small village with a fort, on the east bank of a creek named Meda at the mouth of Wartu river; the creek is dry at low water. The bandar of Miani is on the west side of the creek, near which on a hill about 180 feet high, stands a pagoda or old Hindu temple, called Hersad Máta.

Between Porbandar and Miani the coast is low, rising gradually to the hills at Miani. The bottom is rocky within the 10-fathoms contour-line, which is distant about 2 miles from the shore; outside this depth the soundings gradually increase, over mud and rock, to 20 fathoms at 10 miles from the land.

The COAST from Miani to Madhi trends in a north-westerly direction 22 miles, forming a high sandy ridge, broken here and there, in gaps; the only remarkable objects being two small conical hills 3 miles south-east of Madhi.

Proceeding northward from Miani, the water becomes deeper and the bottom rocky with mud intermixed; the soundings are 15 fathoms at 2 miles, and 20 fathoms at about 5 miles from the shore.

Lamba, situated 5 miles north-west of Miani, is a small town with a population of about 1,400, lying 1½ miles from the sea; during fine weather country vessels load grain and timber abreast this town.

Madhi, situated 17 miles north-westward of Lamba, is a hamlet with a small dark-looking temple and old tower, standing on elevated rocky land near the coast.

PENINSULA of OKHAMANDAL.—The western shore of Okhamandal district extends from Madhi to Okha point, a distance of 30 miles, and is under the Kamavisdar of Dwarka, who is appointed by the Gaekwar of Baroda. At high water spring tides, and in the south-west monsoon, it is very nearly insulated by the submergence of the

See charts, Nos. 1,420 and 43.

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Rann, a salt marsh that extends from Madhi for 12 miles to the north-east, into the bay between Pindtarak and Poshetra, villages on the shores of the gulf of Kutch. Salt is left on the Rann by the receding tide, which the natives are permitted to collect free of tax.

Okhamandal is very low, the substratum being sandstone. The soil is indifferent, and only cultivated around the villages; bájri and til are the only grains that thrive; the agriculturalists depend on the south-west monsoon for a supply of water, wells being scarce. The prickly pear grows profusely all over the peninsula, and, interspersed with the bábul or leafless thorn, form thick jungles. The conch shell is found in great quantities on the shoals along the northern shore and around Beit island, and is an article of commerce, as on both shores of the gulf of Manar.

But for the great temples of Dwarka and Beit, the Okhamandal district would be unimportant. Camels of a small species are bred here for sale in Kathiawar. The coast is composed of sand-hills between Madhi and Dwarka, cliffs between Dwarka and Kutchgurh, thence sand-hills for 12 miles to its northern extreme.

Wachu, a village with a large round tree, nearly 5 miles south-eastward of Dwarka, is conspicuous; between the village and Dhrewar is a fresh-water stream called Okha-nadi, which during the rainy season bursts into the sea. There are many such streams along the Kathiawar coast, which have at their mouths gaps in the coral reef which fringes the coast, furnishing good landing places where small boats can lie aground in the mud, as they do at Okha-nadi, and load with firewood.

DWARKA TEMPLE, also called Juggat, is a shrine of very great sanctity, and is resorted to by large numbers of pilgrims from all parts of India; it stands within Dwarka fort, on an eminence close to the sea. The structure is of stone, carved with figures from the base to the summit, and, being whitewashed all over, forms a conspicuous landmark. It is elevated above the sea level 168 feet, and is visible seaward from a distance of 17 or 18 miles in clear weather. A short distance westward of the temple, close to the edge of the cliffs, a column commemorates the capture of Dwarka by the British.

The Gomti is merely a stream that drains the country in the rainy season; at low tides its mouth is closed. The landing place is on the steep sandy beach between the cliffs and the mouth of the Gomti, by an old dark-looking temple washed by the sea at high tide; but with any southerly swell there is too much surf, and boats should then proceed into Rupen creek.

LIGHT.—A *fixed white* light, elevated 70 feet above the level of high water, is exhibited from a lighthouse at Dwarka point, and should be

See chart, No. 43.

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seen in clear weather from a distance of 12 miles.* The lighthouse is a square stone building 25 feet in height, and is situated 117 yards within high-water line.

Position.—Latitude 22° 14′ N., longitude 68° 57′ E.

Rupenbandar, the port of Dwarka, 1½ miles northward of Dwarka point, is marked by a square flat-topped house on a sandy neck of land, on the north side of a creek. Rupenbandar is shallow and much obstructed by rocks at the entrance. The small country vessels which visit this port lie aground at low water on a fine sandy beach where the water is smooth, as the sea breaks on the fringing reef half a mile to the westward. The force which invested Dwarka in November 1859 was conveniently landed here.

The cliffs between Dwarka and Rupenbandar, about 40 feet high, are covered with cactus bushes.

Anchorage.—For large vessels, the best anchorage is in 11 to 12 fathoms, sand, with Dwarka temple bearing E.N.E., distant 1½ miles, but the holding-ground is indifferent towards the entrance of the gulf; the surveying vessels lost several anchors.

Landing can only be effected in Rupenbandar during the south-west monsoon.

Tides.—It is high water, full and change, at Rupenbandar, at 10 h. 30 m.; springs rise 10 feet, neaps rise 7 feet. Abreast Rupenbandar the flood sets northward sometimes more than 2 miles an hour, and the ebb to S.S.E. at about the same rate. Farther northward the tides increase in velocity, rendering navigation difficult.

Beerwarah is a large walled town standing between Dwarka and Kutchgurh. A square tower in the town is a good mark, and visible from several miles seaward.

Kutchgurh, 5½ miles north of Dwarka, is situated at the head of a shallow bay, open to the north-west, where there is good landing on the sandy beach north of the fort; the beach is frequented by turtle. The intermediate shore is fringed with a coral reef and rocks, extending half a mile. Two miles to the northward of Kutchgurh there is a sand-hill with bushes on it, about 100 feet in height.

VOMANI POINT.—From Kutchgurh the coast trends in a north-easterly direction 11 miles to Vomani point, the north extreme of Okhamandal, and is fronted by reefs extending 1½ miles from the shore.

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* This light is said to be visible only 3 or 4 miles.
See chart, No. 43.

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The Chora sand-hills extend from Kutchgurh to within 3 miles of Vomani point, on which there is a small conical mound, elevated about 25 feet above high water.

GURUR SHOAL, composed of sand and rock, extends over a length of 10 miles, north-east and south-west and has 7 fathoms least water on its southern half. The northern part has depths generally of $3\frac{1}{2}$ to $4\frac{1}{2}$ fathoms upon it, but at the north-east end, at $4\frac{2}{3}$ miles N.W. $\frac{1}{2}$ N. from the lighthouse on Samiani island there is a sandy knoll named Beka, which dries at low-water springs. Beit cocoa-nut trees (third clump eastward of Padmatirth point) seen just to the right of the lighthouse leads over this knoll.

The soundings in the channel between Gurur shoal and the shore reef are irregular and vary from 7 to 20 fathoms, but there are small patches of $2\frac{1}{2}$ and 3 fathoms lying $2\frac{1}{4}$ miles from the mainland from which Samiani lighthouse bears E. $\frac{1}{2}$ N.

The lighthouse bearing between East and E. by S. leads over Gurur shoal in not less than 8 fathoms; Dwarka temple in line with Kutchgurh fort S. by E. clears the shoal to the westward.

Between Gurur shoal and the mainland, during a calm on the ebb tide, the sea sometimes breaks even in deep water; and on both tides there are heavy ripps causing alarm to a stranger. When standing in towards the Gurur shoal, the change in the colour of the water, the ripplings, and great quantities of seaweed in large patches drifting on the surface, point it out by day. But the soundings are a sure guide; the 20-fathoms contour-line is decidedly marked; and the depth will often decrease 10 fathoms at a cast if approaching the shoal from the westward at a fair speed. In westerly winds there is a holiow breaking swell on the Gurur.

By night, a vessel not bound into the gulf of Kutch should avoid shoaling under 20 fathoms off its mouth.

Tides.—At the west edge of the Gurur shoal, 9 miles west of Samiani lighthouse, the flood stream at neaps was observed to run N.E. by E. one to $1\frac{1}{2}$ knots, and the ebb S.W. by W., one to $1\frac{3}{4}$ knots an hour.

LUSHINGTON SHOAL (Unnia-mor), in latitude 22° 38′ N. and longitude 68° 48′ E., consists of sand over a rocky foundation upon which the least depth found in 1850 was $3\frac{1}{2}$ fathoms at low water, since when it is supposed the depth has gradually decreased. From the shoal Dwarka temple bears S.S.E. 25 miles, Beka shoal E.S.E. 13 miles, and Nanu hill in Kutch is visible in clear weather bearing N.E. $\frac{1}{2}$ N.

Soundings.—The soundings are 15 fathoms at one mile southward of Lushington shoal, and 10 fathoms in all other directions at that distance.

See chart, No. 43.

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A 10-fathoms bank extends south-westward for 15 miles, upon which, at a distance of 4 miles, was found a cast of 5 fathoms. The depths are 14 fathoms at 4 miles north of Lushington shoal, whence they gradually decrease to the Kutch coast. Eastward, between it and Ranwara shoals, there is a deep with 30 to 35 fathoms.

Tides.—It is high water, full and change, on Lushington shoal at 11 h. 30 m.; ordinary springs rise 10 feet. The tides set E. by N. and W. by S. $1\frac{1}{2}$ to $2\frac{1}{2}$ knots an hour.

See chart, No. 43.

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CHAPTER VIII.

THE GULF OF KUTCH.

(Long. 69° 0′ E. (lat. 22° 40′ N.) to long. 70° 25′ E.)

VARIATION, at the entrance 0° 55′ East, and at the east end 1° 5′ East, in 1900.

The gulf of Kutch is formed by the coasts of Kathiawar and Kutch, and possesses some sheltered anchorages and harbours. It is 28 miles wide at the entrance, between Okhamandal and Abdullah Shah's tomb in lat. 22° 56′ N., long. 69° 3′ E., and extends 70 miles in an easterly direction. The shores are uniformly low, the northern consists of sand and mud, and the southern is fronted with islands covered with brushwood, and surrounded by coral reefs. Local knowledge is necessary when navigating the channels between these islands and reefs.

The soundings are very irregular for a distance of 30 miles within the entrance, and there are dangerous outlying shoal rocky patches extending 8 miles off the Kutch coast; thence eastwards the soundings decrease generally towards the shore, and the bottom changes from rock and sand to mud.

Across the mouth of the gulf the rapid tides over the uneven bottom cause a very confused breaking sea.

SOUTHERN SHORE.—Okha point, the north-east extreme of Okhamandal, at one mile east of Vomani point, is low and sandy, but steep-to on its east side. Between Okha and Vomani points foul ground extends half a mile from the shore. The land on the east side of the peninsula from Okha point to Aramra bandar, at about 3 miles south of it, is low, covered with jungle of cactus, and is fronted by a sandy beach. At Aramra the ground rises to an elevation of about 50 feet.

SAMIANI ISLAND, 15 feet high, situated three-quarters of a mile north of Okha point, is about half a mile long, north-east and south-west, and 150 yards wide; towards its north end there is a small mound, with a tomb, 35 feet high. The island is comparatively steep-to

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See chart, No. 43, and plan of Beit harbour, No. 47.

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on its west side; but from the north extreme, a reef partially dry at half tide, extends in a north-east direction 1½ cables, with deep water close to.

On the west side of Samiani, and separated from it by a channel one cable wide with 5 fathoms water, lies a shoal nearly 2 miles long east and west, and three-quarters of a mile across the broadest part. There are depths of 6 to 15 feet on this shoal, but its north-east edge dries for one mile at lowest spring tides.

LIGHT.—Near the centre of Samiani island stands a stone circular white lighthouse, 65 feet high, from which, at an elevation of 71 feet above high water, is exhibited a *fixed white* light with *red* sectors, visible in clear weather from a distance of 12 miles. The light is seen from N. 53° E., through east and south to N. 8° E.; sectors of *red* light are shown over Chinri reef between S. 37° W. and S. 67° W., and over Paga bank from S. 80° W. to N. 70° W.

BEIT ISLAND, situated about one mile east of Okha point, is 5 miles in extent north-east and south-west, and less than a mile across; its eastern part is composed chiefly of sand-hills, its western of rocky tableland. On the northern part of the island there are three topes of cocoa-nut and a few other trees, elsewhere it is almost entirely covered with open jungle of prickly pear bushes and thorny scrub. Beit is one of the few great resorts of pilgrims in the north-west of India, and has numerous temples and shrines in honour of Kristna. The only building at the eastern part of the island is Hanuman temple.

Hanuman reef extends 1½ miles to the north-east of the island, and at low spring tides dries from half to three-quarters of a mile from the shore.

Padmatirth point, the north-west point of Beit island, is a small bluff tableland about 30 feet high, which at extraordinary spring tides forms an island; close to the bluff is a small white-domed tomb. The south point, Shankholia, is the highest part of the island.

Beit town, near the centre of the west side of the island, rises to an elevation of about 60 feet. In the highest part are the remains of the fort occupied with the temple, priests' dwellings, and the offices of the Governor of the island. Close to the small landing jetty, are some rather imposing looking buildings for the accommodation of pilgrims visiting the temples; the rest of the town is mainly composed of squalid mud houses. A small dispensary, post office, and library are maintained by the Government.

Water.—Excellent fresh water is procurable at Beit; the most convenient places to water from are the Raghasar wells, south of the town;

See plan of Beit harbour, No. 47.

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a boat could be taken within 400 feet of them at high water. No supplies of any kind are procurable except in very small quantities.

Communication is maintained by small native vessels with Mandvi, and a post runner conveys the mails daily between Aramra and Dwarka. From Aramra to Beit the post boat crosses daily at high water.

Population.—The population in 1880 amounted to 2,763, but it is fluctuating, owing to the large number of pilgrims continually arriving and departing. There is no trade in Beit.

BEIT HARBOUR, lying between Okhamandal and Beit island, is almost landlocked, the entrance being protected by Samiani island and numerous sand-banks. It is spacious, but, having numerous reefs, the anchorage for any but small native craft is confined.

There are three channels leading into the harbour; the West, or that between Okha point and Samiani island having the greatest width with deepest water, in which the tides run fairly through, being the best. The North channel, between Samiani and the sand-banks, which dry at low water to the east of it, is narrowed to less than one cable off the end of Samiani reef; and has a bank with from 9 to 12 feet water, stretching across the passage. Off the entrance to the north channel both the flood and ebb streams set strongly across its mouth; the flood to the eastward at a rate of 3 to 4 knots at springs, and the ebb W.N.W. with nearly the same velocity. The East channel is only used by small native vessels, as a bar of rock and sand, with not more than 5 feet on it at low water, has to be crossed.

Anchorage.—The best anchorage is in 3½ to 4½ fathoms, sand, eastward of Okha point, with the site of the old tide gauge (a large heap of stones), bearing from S.W. by W. to W. by N. about 2 cables distant. The anchorage off the town is rocky.

During westerly gales well-sheltered anchorage may be obtained in 5 or 6 fathoms, mud, about half a mile from the east end of Beit island, with Hanuman temple bearing N.W. by W. ½ W., and the sandy extremes of the island from S.W. by W. to N.N.W. ½ W. (Chinri sand ridge being nearly shut in at the latter bearing), where the ebb sets to the northward, but the flood is scarcely perceptible. Eastward of this position the bottom is rocky.

Winds.—At Beit island during the progress of the survey (April 1883), the winds were generally westerly, but towards the end of the month it blew hard for seven days from south and west. This, according to native information, occurs annually between 25th April and 10th May.

See plan of Beit harbour, No. 47.

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Tides.—It is high water, full and change, at Okha point at 0 h. 12 m.; mean springs rise 11½ feet, neaps rise 9½ feet. The tides are subject to a large diurnal inequality, which may accelerate or retard the times of high and low water, sometimes to the amount of one hour or more, and increase or diminish the rise by upwards of one foot :—

		ft.	in.		ft.	in.
From March to September springs rise	A.M.	10	11	P.M.	12	3
„ „ neaps „	„	9	1	„	10	4
From September to March springs „	„	12	3	„	10	11
„ „ neaps „	„	10	4	„	9	1

The tidal stream in and about Beit harbour runs strongly, attaining at springs a velocity of 3 to 4 knots, and at neaps of 2 knots. North of the harbour, outside Samiani, the flood sets to the eastward and the ebb to the north-westward. In the west channel both streams set fairly through, flood to the eastward, ebb westward; but off the south end of Samiani the flood sets strongly round that point, to the south and east, and at Okha anchorage sets south through the harbour, and curves to the east round the south end of Beit island. The ebb from the east around the south end of Beit, sets fair through the harbour, to the north until it reaches the shoal water north-west of Padmatirth point. Here it divides into two streams, one running along the Okha shore, the other to the north-east and northward along the east side of the banks east of Samiani, and thence to the westward. Strong eddies form in the harbour at springs on both tides, and a confused sea on the shallow ground north-west of Padmatirth point. There is a strong undertow at Okha anchorage.

Chinri reef, situated 2 miles north-east of Samiani island, and nearly 2 miles north of Beit island, is generally about 1¼ miles across, and is covered at the top of ordinary tides with the exception of a sand ridge about a quarter of a mile long, on the southern edge of the reef, which only covers at high springs. Shoal water extends a quarter to half a mile from the west and north sides, and 1¼ miles from the east side of this reef; the south side is steep-to. The channel between it and Hanuman reef is nearly one mile wide, with general depths of 5 to 9 fathoms; but between the south-west point of Chinri reef and the shoals east of Samiani, there is a rocky ledge having depths of 2¼ to 4 fathoms.

Directions.—To enter the harbour by the west channel, steer for Samiani island lighthouse with it bearing East. This course will lead north of the small rocky shoal with 15 feet water, situated W. ½ N. 2¾ miles from Vomani point, and when the cairn on this point bears E. by S. ½ S. the shoal will have been passed; thence steer for Samiani lighthouse on an E. ⅜ N. bearing, and, when the whole of Beit town is seen open of Okha point, steer S.E. ½ E., passing the south-west end of

See plan of Beit harbour, No. 47.

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Samiani island at the distance of about 1½ cables, and when it bears north steer S. by E. for the anchorge abreast Okha point. Vessels should, if possible, enter on the flood tide, as when the ebb is running a confused sea is met, more especially off the south-west end of Samiani. Northward of Vomani point this channel is barely a cable in width.

The north passage, or that along the east side of Samiani island, is contracted to a width of less than one cable, by the reef which extends north-east from Samiani, and the sand-banks east of that island; on the end of the reef the surf breaks heavily even at high water, and there is a pinnacle rock on the reef which dries at half tide. To enter by the north channel, after passing the 10-feet bank lying 1½ miles N.N.E. of Samiani, steer to bring the point 1¼ miles south of Okha point (which may be known by having some dark bushes on it), in line with or just open of Okha point; this will lead past Samiani reef. When the light-house bears West, alter course to the southward to clear the 9-feet patch, and, when Vomani point cairn bears W. by S., a vessel will be south of this danger, and may steer to the south-south-west, anchoring abreast Okha point as before directed. Sailing vessels should not as a rule attempt the north passage; it is very rarely used by native craft.

Vessels from the northward, proceeding to the anchorage east of Beit island, should steer for Samiani lighthouse on a S.S.E. bearing (which will lead about 1¼ miles east of Beka shoal) until Chinri sand ridge bears East; thence an E. ½ S. course will lead through the channel, passing about 2 cables south of the sand ridge. When Chusra trees are in line with the south edge of Paga sand, a vessel will be eastward of Hanuman reef, and should steer to the south-east until the Kiu hills are seen just open of Hanuman point, when the anchorage may be steered for, observing that the ebb tide sets in a north-westerly direction on to the reef.

Poshetra bay, situated between the south-east side of Beit island and the mainland of Okhamandal is very shallow, and has in mid-channel a bank nearly dry at low tide. The water deepens towards the south extremity of the island, but numerous sunken rocks exist, and local knowledge is necessary for the navigation of this part.

Poshetra point lies 3½ miles south-east of Hanuman point, and the town of Poshetra stands on high ground, nearly 2 miles south-west from it; there are two large banyan trees north-west of the town, which are conspicuous objects.

There is a sunken reef one mile north-westward of the point; and eastward of it foul ground for nearly two miles, with a sand-bank at the east extreme named Boria, which is only covered towards high water. About half a mile north of Boria there is a small reef, between which and

See chart, No. 43.

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Paga reef lies a deep channel 1¼ miles wide. Chusra trees, touching the north end of Ajad island, is the leading mark through.

When clear to the northward of Boria reefs, Kiu hills will be seen open, north of the land about Poshetra point. When clear to the eastward, the south-east bluff of Okhamandal tableland (8 miles south of Poshetra town) is seen between the Brothers.

Paga reef, situated 2¾ miles north of Poshetra point, is 3½ miles long south-east and north-west, and 1¾ miles across the broadest part. On its west side, and about 2¾ miles east of Hanuman point, there is a sand ridge, which is only covered at high-water springs. Okhamandal, south-east bluff, seen between the Brothers, clears the south-east extreme of Paga reef, and leads to those islands. The highest peak of Barda group, in line with the highest part of Ajad island—seen from aloft—clears the north-east side of Paga reef.

BROTHERS, termed by the natives Sahn, are two islands, 2½ miles S.E. by S. from Poshetra point; the western is the larger, with a flat top, about 60 feet high; the eastern is a small conical islet. There is a good anchorage half a mile east of the Brothers, and also on their west side, in 6 to 9 fathoms, mud, sheltered from all winds.

Southward of the Brothers, in the extensive shallow bay between Okhamandal and Hallar, there are two small islands named Dabdaba and Devdi.

HALLAR COAST.—A rann or salt marsh separates Okhamandal from Hallar, and, during the south-west monsoon, it is overflowed at high spring tides, presenting then an almost impassable salt swamp. The Hallar coast extends from this rann to the head of the gulf, and belongs to the Nawanagar state.

Pindtarak, the frontier town of Hallar, lies at the head of the bay south of the Brothers. The mud in this bay uncovers at lowest tides for nearly 1½ miles north of Pindtarak.

Quoin, situated 3¾ miles eastward of Pindtarak, is the westernmost hill of the high land of Hallar, and stands 140 feet above the sea, from which it is less than one mile distant. On the west of it, the country, towards the tableland of Okhamandal, is low and swampy, except in the vicinity of Pindtarak. North and east of Quoin hill there are many small rocky hills rising out of the swamp, the sea-face of which is fringed with mangroves.

Black bluff, situated 3 miles north-east from the Quoin, is conspicuous, being 60 feet above the sea; eastward of it the mangrove swamp continues for 6 or 7 miles, then slightly elevated country to Seraia

See chart, No. 43.

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Kari creek, which is 13 miles east of the bluff. The highest part of this elevated country is a round hill, about 50 feet above the sea, situated 9 miles eastward of Black bluff.

At 1½ miles W.N.W. from Black bluff there is a small island, named Seori, around which the mud dries at low water.

AJAD, situated 2 miles north of Seori island, is a bluff island, covered with jungle and a little cultivation. On the south extreme, which is 70 feet above the mean sea-level, there is a round hill, on the summit of which stand the ruins of an old Mohammedan tomb. There is a small pool of fresh water on the island after the rains.

Ajad is surrounded by a rocky reef excepi on the south-east side, where the mud dries off less than one cable from the high-water mark of white sand; small vessels may conveniently anchor near this part and obtain water from the pool in the northern bight, to which access may be had by a creek.

Ajad reef extends off the island in a westerly direction 2½ miles, between which, and a small reef three-quarters of a mile west of it, there is a passage three-quarters of a mile wide, having a depth of 12 fathoms in the middle. The west sandy extreme of Bida, seen to the right of Chusra trees, leads clear through this passage into Pindtarak bay. With the west end of Chusra in line with the western extreme of Bida, a vessel would ground on the east edge of this detached reef, which shows two dry sand ridges after half-ebb.

BURAL or CHANKA REEF is separated from Ajad reef by a channel about 2 miles wide, with general depths of 10 to 15 fathoms. This reef, composed of coral and completely covered at high-water springs, is 11 miles long north-east and south-west, and 7 miles across the broadest part; upon it there are four islands. Its northern face is steep-to, with soundings from 20 to 36 fathoms, and the tide runs along it with a velocity of 4 to 6 knots. Off its north-east end there are depths of 15 to 19 fathoms, and beyond this a bank extends in an easterly direction nearly 10 miles, having on it some rocky patches of 7 and 8 fathoms; the shoal water, uneven bottom, and strong tides, cause heavy ripplings and breaks on this bank.

Chusra, a small rocky islet, with a clump of trees on its northern end, stands on the southern extreme of Bural reef, about 3 cables within the south point of the rocks. Chusra trees form a good mark for navigating these inner channels.

Bida, at 2½ miles north-east of Chusra, is a mangrove island nearly 2 miles across; its west face is fronted with sand, the north end of which is about 20 feet above high water.

See chart, No. 43.

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Noru, a low mangrove island 2¼ miles north-east of Bida, is nearly 3 miles in length east and west; its north face is fronted with sand, at the east end of which are the highest trees, about 25 feet above high water.

Near the north side of Noru, where the reef is indented, small coasters, when working with westerly winds, may at low water find anchorage, and wait for the next ebb.

Chanka, the easternmost of the islands on Bural reef, lies 2¼ miles east of Noru, and is covered with trees.

Sunken rock.—In the channel between Ajad and Bural reefs there is a sunken rock at three-quarters of a mile south from Chusra. Beit fort, seen just open northward of Boria sand, leads between this rock and Chusra; and Beit cocoa-nut trees in line with Boria sand, leads southward of the rock. To lead westward of this rock, some portion of Bida sand must be seen to the left, or westward, of Chusra trees.

There is another reef eastward of Chusra, between Bida and Ajad; its south end lies 1¼ miles north of Ajad reef. Poshetra village and banyan trees, seen a little open southward of Chusra, leads southward of it; and Quoin hill, in line with the western bluff of Ajad island, leads eastward of the reef.

Tides.—It is high water, full and change, at Ajad, at 0 h. 50 m.; ordinary springs rise 14 feet, neaps rise 11 feet.

Vudda Kudda reefs, at 2¼ miles north-east of Ajad island, are three separate reefs with passages amongst them. Between these reefs and the south-east side of Bural reef there is a channel half a mile wide, with depths of 4 to 10 fathoms, but, for want of marks, this should only be used when the reefs are uncovered.

The deepest water is near the Vudda Kudda reefs, the sand-heaps on which are dry soon after high water; that on the centre reef is only covered at high-water springs.

On the south-east extreme of the foul ground extending from Bural reef, and about three-quarters of a mile north of the easternmost Vudda Kudda reef, lies a sunken rock with three fathoms water close around.

About 2¼ miles north of this rock, and three-quarters of a mile from the eastern edge of Bural reef, lies the Bubasir rock, from which Chanka island bears N.W. by W. 2¼ miles.

Anchorages.—On the north-west side of Bural reef good anchorage may be obtained in 4 or 5 fathoms, mud, with Chanka trees (seen from aloft), just touching the north sandy face of Noru island, bearing East; and Chusra trees, S. by E. ¼ E., in line with Quoin hill (which is 15 miles

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distant, and only seen from above the deck, and in clear weather). At this anchorage the ebb tide is not felt at all, and the flood very little. Southward of this position there are 3-fathom patches, and from the anchorage a bank of sand and rock, with overfalls, extends westward to Chinri reef, and southward to Paga reef; over which bank the soundings range between 5 and 10 fathoms, but there is in the centre a deep having 12 to 14 fathoms. The bearings of the land must then be the sole guide, as the soundings will not indicate a vessel's position; at spring tides, the ripplings and breaking water frequently alarm a stranger.

To the east and south-east of Bural reef there is good shelter against westerly winds, and anchorage may be obtained in 5 fathoms, mud, at low water, about half a mile south-west of Bubasir rock. A vessel only taking shelter for a single tide may anchor north of the rock in 8 or 9 fathoms, mud, just on the edge of the shoal soundings, with Chanka trees bearing West 2¼ miles; or one mile east of Bubasir with Chanka trees bearing W.N.W. about 3¼ miles, in 8 fathoms, mud, where the ebb sets north-west and the flood south-east.

Care is necessary in approaching Bural reef at high water to keep a good look-out for the trees on Noru and Chanka, which should be given a berth of 3 miles until near Chanka, when a vessel can steer south-east for the anchorage.

Large native vessels arriving from the Malabar and African coasts, after the commencement of the south-west monsoon, seek shelter to leeward of Chanka, and there discharge the bulk of their cargoes into smaller craft, which convey the goods over to Mandvi; the larger vessels follow at spring tides, and run boldly into Mandvi creek at high water.

Gunjao Kudda is an extensive bank 2 miles south of Vudda Kudda, and has on its south-east side an island named Panera, covered with mangrove bushes. Coasting vessels pass at high water between Gunjao and Vudda Kudda, but in mid-channel the water is shoal. There is a boat passage around Panera, and with local knowledge a vessel may proceed to within 3 miles of Simani round hill, 100 feet high, eastward of Panera.

Soundings.—Between Bubasir and Dhani fringing reef, at 4½ miles south-east of it, there are depths of 3 to 9 fathoms, bottom generally mud. In working to the westward, amongst the reefs and islands, the native boatmen usually wait until the banks uncover. The most minute description of these channels would not suffice for the guidance of a large vessel, which should take a native pilot; the tides are strong in some parts, and an intimate knowledge of them is necessary. The set of the tide-stream during the first hour of ebb, when it runs out

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over the reefs, is different from the direction it takes after half-ebb, when confined within narrow, deep, channels.

Gandhia island, at 2 miles north-east of Panera island, stands near the middle of Dhani Bet which covers at half tide; Dhani island, a small sand ridge with trees on it, lies 2½ miles north-east of Gandhia island on a marshy projection from the mainland.

Seraia Kari creek extends nearly 8 miles in a south-easterly direction, between Dhani and Karumbhar reefs, and has an average breadth of one mile, with depths of 9 to 12 fathoms in the entrance, decreasing suddenly near the middle to 5 fathoms when east of Dhani island; thence towards its head the soundings are irregular, varying from 10 to 5 fathoms. The entrance is not easily distinguished, except near low tide, when the margins of the reefs are visible. At the head of the creek there is a small town named Salaya.

Anchorage.—An old banyan tree standing 2 miles north-east of Salaya, in line with a distant conical hill bearing about S.S.E. ¾ E., leads into the creek; when Dhani trees bear W.S.W. open the conical hill a little to the right of the banyan tree, and anchor in 6 to 10 fathoms, mud, with the lighthouse on Karumbhar island bearing N.E.

KHAMBHALIA, situated 6½ miles southward of Salaya, is a large town belonging to Nawanagar. The river Ghi flows westward of the town, from which there is a good supply of water.

Exports consist of cotton, wool, and hides.

Imports are sugar, grain, ghee, spices, dates, and timber.

Karumbhar, situated 3½ miles eastward of Dhani island, is a mangrove island, 4 miles long east and west, and about 3¼ miles across, with a clump of trees on its northern edge; from these trees a narrow low ridge of sand extends to the west point, where the tops of the bushes are 10 feet above high-water mark. The fringing reef, which covers at half flood, projects north of the trees for nearly 1½ miles, forming a point from which the edge trends south-west for 4 miles to the entrance of Seraia Kari, and to the south-east for 2½ miles to a narrow channel that leads round Karumbhar island to Seraia. A vessel may proceed into the channel for half a mile at low water, when the reefs are visible, and be well sheltered from westerly winds in 7 fathoms water, which depth continues 1½ miles from the entrance.

The point of the reef north of Karumbhar is steep-to, the 20-fathoms contour-line running only one mile therefrom; a vessel passing should not approach the point within this depth.

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LIGHT.—Near the north-west point of Karumbhar island stands a white lighthouse 36 feet high, from which is exhibited, at an elevation of 30 feet above high water, a *fixed white* light, visible in clear weather from a distance of 10 miles. Seen between the bearings of S. 59° W. (through south) to N. 18° W.

Narera is a clump of trees fronted with sand, distant 5½ miles eastward of the clump on Karumbhar. A reef extends 1½ miles in a northerly direction, and 2 miles north-eastward, which covers at half-flood. A mangrove swamp joins Narera clump with the mainland.

Goos reef, situated about 1¼ miles east of Narera reef, is 3¼ miles long east and west, and 2 miles broad. Half a mile within its northern side, is a long sand that dries before the reef itself, and shows well.

On its southern and western sides are deep-water channels, that on its southern side has 2 fathoms in it at low water; these channels are used by native vessels when it is blowing very fresh, to avoid the heavy sea outside.

The eastern channel, named Seeka Kari, is navigable for only 3 miles at low water; but, at high water, large boats can pass through channels amongst the mangrove bushes, almost in a direct line to Rojhi, and thence to Bedi.

Dera is a range of low sand-hills, 2 miles north-east of Goos reef; its north-west end is a bluff, about 15 feet high, where there are a few scattered stunted mangroves. To the eastward these trees are thicker, and there are two or three single trees at the distance of one to 1½ miles east of the bluff. The reef extends off Dera sand-hill nearly 1½ miles to the north-west.

Surmut Kari creek entrance lies 4 miles north-east of Dera sand-hills, and vessels may find shelter here from strong north-easters, in 4 or 5 fathoms water, mud, at 3 to 5 cables south-west of Peritan reef, with some high trees bearing from N.E. to E.N.E. It would not be prudent to enter the creek until a couple of hours after high water, when the edge of the reef dries. There are some rocky patches about three-quarters of a mile within the entrance, which render it unsafe to run far in without a pilot.

Peritan is a mangrove swamp, which extends nearly 6 miles east of Surmut Kari, with a sand-bank on its north-east face. Peritan island, situated about one mile north of this swamp, is a good mark for this part of the coast, as the trees, like those of Tekra, on the Kutch coast, are not allowed to be cut down.

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A coral reef, steep-to, and dry at low water, extends from Peritan island, one mile in a north-east direction, and three-quarters of a mile to the south-west.

NAWANAGAR, in lat 22° 27′ N., long. 70° 4′ E., is a flourishing town, nearly 4 miles in circuit, and the capital of the independent state of Hallar, which is ruled by the Jam of Nawanagar; it contains a population (1891) of 48,530. British authority is represented along the south side of the gulf of Kutch by the political agent in Kathiawar, whose headquarters are at Rajkot, 50 miles south-east of Nawanagar.

The Kota is a white circular turreted building on the west side of the fort, 182 feet above the mean sea-level, and may be seen in clear weather from a distance of 15 or 20 miles. The Durbar house, a large gable-roofed building, and a look-out tower outside the fort, are also conspicuous objects.

The principal products of Nawanagar are grain and cotton, and the chief manufactures cloth and silk. A large number of the population are employed as dyers, and the excellence of the dyes given to the local fabrics is attributed to the water of the river Nague, which washes the walls of the town.

Bedi is a small village and fort, near the bandar of Nawanagar, at 2½ miles north-west from the town. Boats can proceed up the creek to within three-quarters of a mile of Nawanagar.

The mouth of Bedi creek lies about 4 miles north of the bandar, and nearly one mile north-west of Rojhi lighthouse; its west side is rocky, and the east side soft mud.

Rojhi, situated a mile north of Bedi, is a rocky island, 2 miles in length north and south, and 1¼ miles across; on the north end stands a Hindu temple.

LIGHT.—A *fixed white* light, elevated 42 feet above high water, is exhibited from a white circular tower on the temple at the north end of Rojhi island, which should be visible in clear weather between the bearings S. 59° E., through south, to S. 59° W., from a distance of 7 miles.

Water.—Close westward of Rojhi, there are trees about 50 feet above the sea, on the edge of a tank of fresh water; watering by ships' boats is easy. Supplies for a Lascar crew are obtainable from Nawanagar.

Tides.—It is high water, full and change, at Rojhi, at 1 h. 40 m.; springs rise 18 feet, neaps rise 14 feet.

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Anchorage.—At about 3 miles north of Rojhi island, with the lighthouse bearing from S. by W. to S.S.W., anchorage may be obtained in 3 fathoms, mud, with Peritan island just open north of the large mangrove island between it and Rojhi. This anchorage is well sheltered from the westerly winds which prevail from February to October inclusive.

West of this anchorage, half a mile, is a small detached reef, dry at low water, having a passage between it and the main reef. At 1½ miles N.W. by N. from the anchorage, lies a 2-fathoms rocky patch, to avoid which, when coming from the westward, do not haul in for Rojhi until the lighthouse bears S. ½ W.

In approaching from the north-east, Bedi fort should not be seen open to the left (or eastward) of Rojhi island, as the ground is rocky eastward of the anchorage.

D'huwao town lies about 3 miles eastward of Nawanagar and 1¼ miles within the line of coast; the entrance of its creek, amongst mangrove bushes, lies 4 miles north from the town, and the mud dries for upwards of one mile beyond the mouth. At about 1½ miles E.S.E. of D'huwao, there is a low table-hill, about half a mile long; and 1½ miles eastward of that are two mounds resembling paps.

BALACHERI is a small village 7½ miles N.N.E. ½ E. of D'huwao; the town of Hariana stands 3 miles further east. Three-quarters of a mile north-west of the village there is a small conical hill, detached from the mainland, and insulated at high water, on the summit of which stands a Mohammedan fakir's place, called Aku Pir. West of the village, there is a small range of rocky mounds, 40 to 50 feet high, fronting the sea, which are isolated at high-water springs, and which constitute the sanatorium of the British residents from Rajkot; when tents are pitched there, they make an excellent landmark.

Between these hillocks and Aku Pir there is a small creek, off the mouth of which lies a large rock, dry at half-tide; the mud and rocks dry at low water, 1½ miles westward.

At the back of Balacheri there is a range of hills, about 100 feet high, which terminate rather abruptly to the southward, at 1½ miles south-east of the village. Nearly 3 miles south-west of Balacheri there is a grove of trees, in the village of Sachana, which may be seen when at anchor south of Mungra sands.

BALACHERI ROCKS.—The south-west extreme of the Balacheri rocks, which forms a projecting reef, bears from Balacheri tent hills N.W. by N. 4 miles. At the same distance W.N.W. from the tent hills,

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there is a separate coral reef, one mile long east and west: its west side is steep-to, and there is a depth of 2 fathoms between it and the mainland, and 4 or 5 fathoms on its north side, between it and the south-west projecting point of the Balacheri rocks.

Anchorage.—Balacheri roads may be approached with Aku Pir bearing between S.E. ½ E. and S.E. by E. ½ E., between which bearings a vessel may anchor, during the north-east monsoon, in 5 to 3 fathoms, according to her draught. The bottom is soft mud, and the anchorage is protected from north-east gales by the reefs to the northward.

JURIA FORT stands nearly 7½ miles from Balacheri; the north-west bastion, about 80 feet above the sea, and the Durbar house are conspicuous; nearly one mile south-west of the fort there is a grove of high trees. These objects point out the place unmistakably, and may be seen, in clear weather, from a distance of 10 to 12 miles. Juria north-west point, 3½ miles west-north-west from the fort, is low and sandy; the bandar is 1½ miles eastward of the north-west point.

Juria bandar house lies N.W. ½ N., 2¼ miles from the fort; the entrance of the creek (amongst mangroves) is with this house, one mile distant, in line with Juria trees. Boats, from Mandvi to Juria, keep along the Kutch coast, and sight Tuna Tekra before they steer for Juria, and run round the east end of Mungra reef, with the bandar house bearing South, into Juria creek; but this cannot be done until after half-flood, by boats drawing 7 feet water and upwards.

Tides.—It is high water, full and change, at Juria bandar, at 1 h. 40 m.; ordinary springs rise 16 feet, neaps rise 13 feet.

MUNGRA REEF lies north-west of Juria; its west end is 8 miles, and its east end 6½ miles from the fort. Between this reef and the mouth of Hanstul creek, at 9 miles north-east of it, the mud uncovers at low water.

At three-quarters of a mile from the west extreme of Mungra reef there is a heap of sand and shells, which is the first part that dries, and then shows distinctly the position of the reef; this heap lies with the north-west bastion of Juria and Durbar house nearly in a line. The west end of the reef has depths of 5 and 6 fathoms close to. There is a 2-fathoms channel along the south side of Mungra reef.

Anchorage.—A vessel may anchor in 4 fathoms, mud, sheltered from strong north-east winds, with the sand-heap bearing N. by E., distant 2½ miles, and Juria fort E. by S. ½ S.

The RANN.—In the north-east monsoon, from November to February, the Rann eastward of Jinghi in Wagur, to Wuwania on the

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south, is dry, and traversable by men and camels, but the fine sand of the surface, agitated by the north-east winds, blinds the traveller. In the westerly monsoon the sea water is propelled by the wind many miles to the eastward, and the Rann is then a great inland sea and quite impassable.

This vast sheet of water is, in the vicinity of the three large creeks which drain it, the Nukti, the Kundlo, and the Hanstul, subject to the regular tides, but the rise and fall is not of any extent, though the Hanstul, from the great height of the internal waters, attains a velocity of 6 to 7 miles an hour at its mouth in ebbing. When, in January 1852, the rise and fall of the gulf water off the mouth of the creeks was 15 feet, it was only 5 or 6 feet to southward of Jinghi, some 15 miles from Hanstul mouth: this difference of level causes the ebb tide, in the Hanstul deep channel, to be of longer duration, and the flood shorter, or, respectively, about 8 and 4 hours.

Between Hanstul creek and the Hallar coast there is a Rann resembling those already mentioned. Its western edge is fringed with mangroves, and the ordinary high-water mark (for in the westerly monsoon it is all flooded at high water) runs down from the Hanstul towards Juria fort, which is 14 miles, S. $\frac{3}{4}$ W. from the mouth of Hanstul creek.

Between the Hanstul and Juria there is a little rocky island on the Rann, called Borakathul, about one mile from the ordinary high-water mark; it is covered with the cactus and other bushes, and fresh water may be obtained on it by digging.

NORTHERN SHORE.—The Kutch hills.—Lunkhi range, situated 15 to 20 miles from the sea, extends in an east and west direction for about 30 miles, nearly parallel with the coast. At the back of this range, and 30 miles N.E. by N. of Mandvi, stands Bhuj, the chief town in Kutch, which has a population (1891) of 25,421.

Nanu hill, 22 miles north from Mandvi, is round, with its summit 1,280 feet above the sea, and may be seen in clear weather from a distance of 40 or 45 miles. There is a range of hills west of Nanu, the highest part of which is a sharp peak named Kri Kubbah, 830 feet high.

The highest eastern hill, named Katrura, at 21 miles northward of Mundra, is 1,000 feet above the sea, of a round form, and may at times be seen from the Hallar coast.

ASAR is a Hindu temple, situated on the crest of the sand-hills close to the sea, at about 10 miles south-east of Abdullah Shah's tomb; its dome is 113 feet high, and may be seen from a distance of 12 miles. Rocky, uneven ground extends upwards of 3 miles in a south and south-easterly direction from Asar.

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The coast between Asar and Mandvi is fronted with fine white sand-hills about 80 feet high, which at night are very conspicuous; the shore should not be approached within 3 miles.

Tides.—It is high water, full and change, at Asar point, at noon; ordinary springs rise 12 feet, high springs 15 feet, neaps rise about 8 feet; velocity, 3 to 4 knots an hour.

Ma Tamasha, a Mohammedan tomb, nearly 4 miles east of Asar, is 100 feet above the sea; the little creek east of this tomb abruptly terminates the high sand-hill of Ma Tamasha, and forms of it a steep sandy bluff.

Between Ma Tamasha and Mandvi, patches of rock and sand, with 9 feet to 3 fathoms water, extend more than 2 miles off shore, the depths then gradually increase to about 9 fathoms at 4 miles distance; outside that, and westward towards Asar, there are overfalls from 3 to 14 fathoms. The tides, running with great velocity over these rocky patches, cause a heavy rippling and break, which is deceiving to a stranger.

MANDVI, the most important commercial town in the gulf, situated 3½ miles eastward of Ma Tamasha, is surrounded by a wall flanked with bastions, within which is the Rao's palace, a large flat-roofed building, forming a conspicuous landmark. The sea-gate is near the south-east angle of the fort, from which the narrow channel of the creek skirts the east side of the town, and affords a passage for small boats only at high water. On the east side of the creek beyond the village of Salaya and near the Residency Bungalow, there is a rest house for the use of European travellers.

The population of Mandvi, numbering 38,155 in 1891, comprises Banians and Bhatias; Rajputs with other Hindus of various castes, and Mussulmans. The two first-named are wealthy, and their religion binds them not to take the life of the smallest creature. They pay a tax to the Rao, who in consequence forbids that the peacocks and pigeons (so numerous in and around the town) should be killed. Strangers would give great offence if, through ignorance of native prejudices, they slaughtered these birds.

The crews of the native vessels which trade with Africa and Arabia are sometimes Mussulmans, but principally Hindus; as sailors they are bold and skilful, the Rajputs notably so. The pilots of Kutch are deservedly famous for skill and daring; many of whom have quadrants and nautical tables, and can determine the latitude by sun and pole-star. Some of the Kutch boats are large, well-built, and decked, and carry a pair or two of carronades. They sail for Africa about the beginning of October, and return just before or with the south-west monsoon.

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Mandvi creek is protected against westerly winds by the Albert Edward breakwater, 1,850 feet long, and boats drawing 9 to 10 feet water can enter the creek at high-water neaps. There is also a pier and pitched slope, where boats can secure alongside and load or discharge cargo.

Trade.—Mandvi is a very opulent and busy port; its merchants trade with Sind, Kathiawar, the ports of western Hindustan, the Persian gulf, Maskat, the Red sea, Zanzibar, &c.

The cloth yard-measure used is the guz, of a trifle over 33½ English inches, and there are 24 tasu to one guz. The current coin of Kutch is the kúri, 404 of which go to 100 Bombay rupees. By the native merchants, trade is calculated in dollars and venetians.

Imports.—From Bombay are imported the usual European goods and refreshments consumed by the British troops in Kutch, and a large quantity of English thread, with which the Mandvi cloth is woven. The imports from Africa are ivory, rhinoceros hides and horns, cocoa-nuts and betel-nuts; a gum called chund-roz, used in dyeing and varnishing; at times, seeds, as joári, mung, and til; gold in dust and ingots, dollars and venetians. Also a large quantity of cheap coarse and strong cotton cloth, highly prized for its durability as wearing apparel by the natives of Kutch, is obtained from American vessels at Zanzibar.

Exports.—The exports from Mandvi consist of cotton, cotton-cloths, (all woven with English thread), and brass in wire and rods.

LIGHTS.—There is exhibited from a white masonry tower 56 feet high on the south-west bastion of Mandvi fort, at an elevation of 115 feet above high water, a *group flashing white* light, showing *three flashes* at short intervals *every thirty seconds*, which should be seen in clear weather from a distance of 17 miles.

From the end of the breakwater a *fixed red* light is exhibited at an elevation of 24 feet, which should be seen in clear weather from a distance of 8 miles.

Tides.—It is high water, full and change, at Mandvi at 11 h. 33 m. This time is sometimes retarded by several minutes during westerly, and accelerated during easterly winds. The rise at ordinary springs is 15 feet, and sometimes at high springs 17 feet; neaps rise 11 feet.

The tides at the anchorage off Mandvi run at the rate of 3 knots an hour at springs, and less than 2 knots at neaps; farther from the shore they increase in strength, and, on the Ranwara shoals, attain a velocity of 5 knots at springs, and 3 knots at neaps.

Anchorage.—Good anchorage may be obtained in 4½ fathoms, clay, about 2 miles south of Mandvi fort, with Rawal Pir bearing N.E. by E.

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There is a shoal rocky patch at 2¼ miles S.W. ¾ S. from the lighthouse, having 11 feet only upon it, at low springs.

Rawal Pir is a white tomb, 70 feet above the sea, in a clump of trees on sand-hills, 2½ miles E.S.E. from Mandvi fort.

Ranwara shoals, situated 7 to 9 miles southward of Mandvi, are two large rocky patches separated by a channel nearly one mile wide, having near the middle 5 to 10 fathoms water. These shoals, with the adjacent foul ground, occupy a space nearly 7 miles in extent east and west. The northern shoal, on which the sea always breaks, is 2 miles long east and west, and half a mile across; and is said to be dry at low water; the southern shoal, about the same extent, has over it a depth of 12 feet. Mandvi light, bearing N.E. ¾ N., or Nanu hill in line with Ma Tamasha tomb N. ¾ E., leads westward, and Nanu hill, in line with Rawal Pir N. ½ W., or Mandvi light N.N.W., leads eastward of Ranwara shoals.

Mudwah point lies 8½ miles eastward of Mandvi; the intermediate shore is fronted with sand-hills, 30 to 60 feet high. The point is a sand bluff, and extending from it is a ledge of rocks dry at low water, having 2 and 3 fathoms close to. Northward of the point is an extensive back-water, that runs to within 2 miles of Rawal Pir, which is only entirely flooded at very high spring tides, and at ordinary high water in the south-west monsoon.

Behind Mudwah point there is good shelter for small vessels hauled up in the south-west monsoon. On the bar there is a depth of about 12 feet at high-water springs. To the south-west of the bluff, the sand dries out for nearly one mile from the shore at low water.

The coast, east of Mudwah, recedes 2 to 3 miles from the low-water margin. There are, however, long thin ridges of sand, 5 to 10 feet above high water fronting the sea, and distant therefrom 5 cables to one mile at low water. Between these sand ridges and the mainland there is an extensive swamp, which is covered with mangroves and intersected by numerous small creeks, where firewood may be obtained.

NAVINAR (Nowanar) POINT, 20 miles eastward of Mandvi, consists of a few ridges of sand, the highest part of which is not 10 feet above high water. The mainland recedes 4 miles from the point, the intermediate space being a swamp partly covered with mangrove bushes, through which several small creeks run. At 5½ miles N.W. by W. ½ W. from Navinar lighthouse, there is a sand-hill about 60 feet high, called Modwa. The 10-fathoms contour-line passes only half a mile south of Navinar point; eastward of it there is shelter for small vessels, during

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westerly winds in 12 to 18 feet water, out of the strength of the tide, with the lighthouse bearing W.S.W.

LIGHT.—On Navinar point stands a white lighthouse, 60 feet in height, from which, at an elevation of 50 feet above high water, is exhibited a *fixed white* light, visible between N. 67° E., through north, to S. 67° W., which should be seen in clear weather from a distance of 13 miles.

Tides.—It is high water, full and change, at Navinar point at 0 h. 47 m.; springs rise 16 feet; neaps rise 9 or 10 feet.

Sonar Durree, a sand-bank lying between Mudwah and Navinar, consists of detached ridges of sand, which dry at low water; its western end is 4 miles S.E. ¼ E. from Mudwah point, and the eastern extremity, 5¼ miles W. by S. from Navinar lighthouse. Sonar Durree is steep-to on its south side, having 10 fathoms at 2 or 3 cables to seaward. During the first half-flood, and after ebb, the shoals may be distinguished by the rippling of the water; and invariably from the masthead by the discoloured water on them. There is no navigable passage inside this sand-bank.

Navinar lighthouse bearing E.N.E., (the light in sight at night,) clears Sonar Duree to the south-east; a large banyan tree at Gundiari (5 miles north-west from Mudwah point) seen just open to the right, or eastward of the high part of that point, will lead south-westward of Sonar Durree.

Mundra creek, situated 3 miles north-east from Navinar point, runs one mile in a north-west direction, between mangrove bushes to a bandar house which is isolated at high-water springs, the tide flowing a mile to the northward of it. There is a road from the bandar to the town, and a quay wall where small vessels may secure.

Mundra fort, situated 2 miles north of the bandar house, has a white mosque and a grove of high cocoa-nut trees, half a mile to the westward of it.

THE COAST, between Navinar point and Nukti creek, trends in an easterly direction about 26 miles, having a mud flat extending off it the whole distance, which dries for about 2 miles.

For a distance of 7½ miles eastward of Navinar lighthouse, there are several shoals with a general depth of 2 and 3 fathoms upon them, lying 2 miles outside the edge of the mud flat; at 2 miles E. by N. ½ N. from the lighthouse, there is a small knoll with 6 feet water. There are depths of 5 to 8 fathoms close around these shoals.

Bhadreswar Temple, 11 miles E.N.E. from Mundra, has a small white dome which points it out, and may be seen at the distance of 9 or

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10 miles from a vessel's deck. There is a grove of trees south of the temple, and Bhadreswar fort is situated a little west of it.

Tuna fort stands about 11 miles E.N.E. from Bhadreswar fort; the intermediate shore is low and sandy, with two or three small villages.

NUKTI CREEK, called also Tuna creek, as one branch of it leads to Tuna bandar, lies 13 miles east from Bhadreswar; its West point is very low, covered with mangrove bushes, and nearly overflowed at high water.

Tekra, situated in the entrance of Nukti creek, is a mud island, 15 feet high, covered with trees; it is three-quarters of a mile long, north-west and south-east, and about half a mile across. Boats bound from Mandvi to Juria on the opposite side of the gulf, in the north-east monsoon, run along shore and sight Tekra before steering to the southward.

There is a passage into Tuna creek on either side of Tekra, for boats after half-flood, but both channels are closed at low water by a bank of sand extending south of the island. A vessel drawing 9 feet may at high water round the lighthouse point, making allowance for the flood tide, which sets across N.N.E., about 4 knots at the springs. The eastern channel is the best defined, as it is nearly straight, along a steep mud-bank; it trends about W.N.W., after the vessel has passed round to the eastward of Tekra.

Buoy.—A black and white buoy is moored in 12 feet water, at the entrance of Nukti creek. Native craft entering the creek must keep on the east side of, and close to, the buoy.

LIGHT.—On the south-eastern edge of a low mangrove swamp, covered at high tides, nearly a mile southward of Tekra island, stands a lighthouse 34 feet high, from which, at an elevation of 32 feet above high water, is exhibited a *fixed white* light, visible in clear weather from a distance of 6 miles.

Tuna bandar lies 4 miles north-west from Tekra, and is the sea-port of the large town of Aujar. Boats of 50 tons burden get there, but with difficulty, at high spring tides; it is up a small creek, not 30 yards wide, marked with posts on each side of the entrance. The flood stream runs past the mouth of this creek to the northward, with a velocity of 4 miles an hour.

Tides.—It is high water, full and change, at Tuna bandar, at 1 h. 50 m.; (outside the entrance) high springs rise 18 feet, ordinary springs 16 feet, neaps rise 13 feet.

See chart, No. 43.

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Rohar Kara, at 7½ miles north east of Tuna fort, is a small village, inhabited by a few fishermen and wood cutters. Above Rohar the villages are Meeta Rohar, Padana, Wursana, Chota Chiri, and Bara Chiri. These villages all lie about 3 miles from the channel of the Nukti, and one to 2 miles from high-water mark. Along this coast many freshwater streams empty themselves during the rains.

Kundlo creek joins the Nukti 3 miles above Rohar; beyond this Nukti creek runs in a north-easterly direction, and is navigable for about 10 miles by wood-boats of 15 to 20 tons; farther northward it is divided into small streams, which help to drain the Rann.

The Nukti is very shallow in some parts, especially one mile south of Rohar, where, in January 1852, there was not so much as 4 feet within a quarter of a mile of the surveyor's boat at high water in the daytime, two days before full moon; at night there was 2 to 3 feet more.

Kundlo creek mouth, amongst mangrove bushes, at about 5 miles east of Tuna Tekra, runs nearly North for 8 miles to its junction with the Nutki.

The ground between these two creeks is termed by the natives Rann island—apparently sandy when dry, but slippery and muddy when wet. It is intersected by numerous small creeks, along the banks of which grow mangrove bushes, which are cut for firewood. The south side of the island has narrow ridges of sand along it, and inside there are two or three small detached mangrove trees which may be seen at a distance of 5 miles. During the south-west monsoon and at spring tides it is overflowed at high water, but at neaps in the north-east monsoon it has time to dry.

On the west bank of the Kundlo, at 7 miles within the entrance, there is a small deep creek, named Jafferwali Nal, in which there is a pier accessible to small craft at any time of tide. The bandar is connected with Rohar Kara by an iron bridge across the Nukti. There is a good traveller's bungalow and a large Dhurmsala at Rohar.

HANSTUL CREEK, which has its mouth 7 miles south-east from the Kundlo, is the largest of the three creeks that carry the sea water into the Rann of Kutch. The space between Hanstul and Kundlo creeks, of the same description as that between Kundlo and Nukti, is only flooded at high water in the south-west monsoon. To the south-west of this island the sand and mud uncover at low water 4 miles seaward; between this bank and the mud bank on the south, lies the channel for the sea waters to pour into the Hanstul, where at 8 miles within its entrance there is a large expanse of level ground, flooded at high water. The flood and ebb attain a velocity of 6 and 7 miles an hour in the channel between the mangrove bushes, where it is only 4 to 5 cables wide.

See chart, No. 43.

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Between Kundlo creek and Juria there are numerous shoals; local knowledge is therefore necessary when navigating this part of the gulf.

The trend of the Hanstul is about east for 2 miles, thence gradually bending to the north-eastward. At 5 miles from its entrance the Halai kari branches off in an easterly direction; and another branch, the Kutchi kari, runs to the northward along the east face of Rann island, between the Kundlo and Hanstul. The whole north side of the central island is intersected by numerous small creeks, where boats obtain firewood, the supply of which is almost inexhaustible.

The Halai is navigable by vessels drawing 9 feet water for a distance of 4 miles from its leaving the Hanstul; to the eastward it becomes a mere ditch, but canoes or small boats can get within a mile of the mainland sand-hills at high water.

The Hanstul, from where the above-mentioned creeks branch off, trends to the north-east, and is navigable by moderate sized boats for 6 or 7 miles; but as the mangroves cease after 2 or 3 miles, there is but the ripple of the water in the deeper channel to point it out.

The whole space eastward of the mangrove bushes, from the Hallar coast on the east, the centre Rann island on the west, and the Wagur coast on the north is, at high water, like a large inland sea of only a few feet depth; and in the westerly monsoon is navigated by boats of 3 or 4 feet draught, which have to glide through the mud as they approach either shore.

Tides.—It is high water, full and change, at the Hanstul mouth at 1 h. 40 m., and is about 2 hours later up the creeks, at the eastern limit which the sea-water reaches.

See chart, No. 43.

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CHAPTER IX.

COASTS OF KUTCH AND SIND—ASAR TO KARACHI.

(Lat. 22° 50′ N. to lat. 24° 50′ N.)

VARIATION, 0° 55′ East in 1900.

The COAST westward of Asar trends in a north-westerly direction, almost straight for a distance of 44 miles to Godia creek; it is uniformly low, and is fronted by a narrow sandy ridge, averaging 30 feet in height, but which, near Asar, reaches 70 or 80 feet. Villages are numerous, and the land well cultivated. From Godia creek westward the land is very low, and much indented; and is intersected with creeks, the mouths of which are shallow, and are only navigated by fishing boats. Shoal water extends about 4 to 7 miles from the shore, for a distance of 20 miles to the entrance of Kori creek.

From Abdullah Shah's tomb to Kori creek the 10-fathoms contour-line of soundings lies nearly parallel to and about 20 miles from the coast, towards which it shoals gradually, bottom mud; there are no outlying dangers.

GODIA CREEK may be known by some small mounds, 30 feet high, at its entrance, in latitude 23° 16′ N., longitude 68° 34′ E.; upon which are two wooden beacons with cross arms placed half a mile apart. At about 6 miles N.W. ½ N., from these beacons, there is a single beacon of the same appearance, about 29 feet above sea level.

The bar dries at low-water springs. To enter the creek, small vessels or boats must cross the bar with the easternmost beacon bearing N. by E. ½ E., until the water deepens, then steer to the eastward for the deep water point on the south side of the river, and anchor in 2 to 3 fathoms. Native boats proceed 3 miles further up to discharge and receive cargoes at the bandar, between 3 and 4 miles south-east of which is the town of Jakhau.

Tides.—It is high water, full and change, at Godia creek at 11 hours 19 minutes. Springs rise 8½ to 12 feet; neaps rise 6 to 7 feet.

KORI CREEK, one of the outlets of the Rann of Kutch, once formed one of the Indus mouths; it is very shallow, but is navigated by a

See chart, No. 43.

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few native vessels as far as Lakhpat, which formerly possessed an important trade. Since the communication of the creek with the Indus was cut off, partly by the artificial erection and partly by the natural formation of a great embankment, named the Ullah Bund; its trade has dwindled away, its houses are tenantless, and altogether it presents an aspect of decay.

The entrance, which is 13 miles wide, is blocked by several sand-banks, except on the eastern side, where a channel leads into the creek. After crossing the bar the main channel, which is steep-to on both sides, runs along the east bank.

The creek is 3 to 4 miles across for a distance of 30 or 40 miles, its banks are only 2 to 5 feet above high water, intersected by creeks. Off the mouth, in 3 fathoms the low land is not seen from the deck, except in the clearest weather, and then the low hills to the north-eastward are visible, the most prominent of which is Maniara hill and fort.

Bar.—The least water on the bar of Kori creek, at low-water springs, is 10 feet, with a depth inside varying from 11 to 3 fathoms.

Tides.—It is high water, full and change, on the bar of Kori creek at about the same time as at Karachi, *viz.*, 10 hours 19 minutes; springs rise 8½ to 12 feet; neaps 6 to 7 feet. At Kotishwar, 15 miles inside the creek, it is high water, full and change, at 11 hours 15 minutes; springs rise 10½ feet. At Lakhpat, more than 30 miles from the mouth, it is high water at 0 h. 15 m.; springs rise 12 feet. The tides are strong in the channel, running 5 knots at springs and about 3 knots at neaps. The flood sets generally up the channel, but at three-quarter flood sweeps over the sand-banks in the entrance. During the survey of the entrance, three native craft were totally wrecked through the flood tide sweeping them on to the banks.

Directions.—As the channel and banks are liable to constant changes, it is useless to give any direction for entering the creek, vessels wishing to do so should obtain a local pilot.

The SIND COAST from its south-east boundary, which is the north bank of Kori creek, trends in a general north-westerly direction for 65 miles to Hajamro beacon, thence more northerly 47 miles to Karachi. The shore is low, flat throughout, and partially overflowed at high water to a considerable distance inland. With the exception of a little jungle, it is destitute of trees or shrubs, and nothing is seen for many miles but a swamp. Wherever this occurs the land is scarcely discernible at more than 2 miles from the shore, except where bushes exist; these can be seen at low water from a distance of 5 or 6 miles.

On a coast so devoid of objects, and at times partly submerged, it is often difficult to distinguish the different mouths of the Indus, and but few

See chart, No. 118.

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directions can be given to assist the navigator in recognising them. The Sir creek may be known by two sand mounds at the entrance, one on either bank, the southern mound is 5 feet high; the northern mound is 8 feet high, and upon it stands a wooden beacon which is 40 feet above the sea level. There is also a conspicuous beacon 90 feet high near the Hajamro mouth which is a good mark, and serves as a guide to approach Kediwári mouth.

The coast of Sind is difficult of approach for vessels of deep draught; a narrow belt of sand-hills generally forms the sea face, backed by patches of dense mangrove jungle, which is cut as fuel for the Karachi mart. During the heat of the day a peculiar haze hangs over the land, and the sand-hills are difficult to recognise from a distance of more than 4 or 5 miles. The coast is generally clearest in the early morning, or before the light alluvial sand is sufficiently dry to be moved by strong winds, for the air generally holds it in suspension when fresh breezes prevail.

Few supplies of any kind can be procured near the coast, but between Baghiar and Hajamro large herds of cattle graze on the grass with which the flats are covered; the owners build low mud walls round their villages, into which they drive the cattle when the water rises. Wells of brackish water may be found a short distance from the different mouths.

In the vicinity of Karachi the land is higher; and, westward of that place, the high range of mountains, terminating in Ras Muari, unmistakably point out the north-west extreme of the Sind coast.

RIVER INDUS.—A general description having been given of this river in the first chapter (*see* page 22), mention will only be made of its several mouths. The main river, after passing Haidarabad and Tatta, divides about 50 miles from the sea into two grand arms, and discharges by the Kediwári and Baghiar mouths; between these two principal mouths are several others by which fresh water is discharged. Great changes have taken place off the entrances to the mouths since the survey of 1877, but they do not extend out to the 10-fathoms contour-line, which has not materially altered in position.

Tides.—The descent of the delta being great, the tides are not perceptible more than 30 miles from the ocean, and so feeble is the flood, at the distance of 10 miles above the bar, that vessels scarcely swing to it; the ebb, on the other hand, rushes out, causing a high ripple, which would very probably be mistaken at night for shoal water, and, particularly at the junction of the salt and fresh waters, where the sea has a whitish and sometimes at night a luminous appearance. During the inundation the water is frequently fresh at the mouths of the rivers, and a vessel at anchor will often have good fresh water though muddy, on one side, and

See chart, No. 118.

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clear salt water on the other; the boundary line of the two waters is observable several miles seaward.

Sir Mouth.—The beacon on the right bank of the Sir, is in latitude 23° 41′ 33″ N., longitude 68° 8′ 9″ E. The entrance which faces the south-west is flanked by shallow spits, which dry in places and extend 4 to 6 miles from the shore. The bar, on which there is 12 feet at low water, is situated between the points of the spits. The channel with a width of about one mile runs along the left bank with a depth of 3½ to 10 fathoms. The Sir is navigable by small craft for some distance from the bar, but there is no trade, and it is used only by fishing boats and native passenger boats passing through the creeks.

The Tides.—At the bar, it is high water, full and change, practically at the same time as at Karachi, *viz.*, 10 hours 19 minutes, springs rise 11 feet; at the entrance the tides are about half an hour later. At Juggi, the farthest navigable point of the Sir, it is high water, full and change, at 1 hour 30 minutes, the rise being 6 feet. The tides at the bar set fairly in and out, at the rate of 3 to 4 knots at springs; at 10 or 12 miles off, the ebb sets W.N.W. and the flood E.S.E. about 1½ miles an hour at springs, but much weaker at neaps.

THE COAST from Sir mouth trends in a north-westerly direction about 20 miles to Wari creek, from whence a bank of sand and mud, which extends 4 miles from the shore and dries in patches at low water, fronts the coast for about 20 miles as far as Kalandri creek. The coast inside is very low and not visible from the 10-fathoms contour-line; but temporary huts are occasionally erected and these may sometimes be seen. Four miles north-west of Kalandri creek is a sand ridge 2 to 3 feet high, this and two other small sand ridges are the only objects likely to be seen until in the neighbourhood of Kediwári mouth, when the Hajamro beacon will be visible.

THE SWATCH.—At a distance of about 35 miles west from the Sir mouth, and about 5 or 6 miles from the bank fronting the coast, lies the northern extreme of a deep, named the Swatch. This remarkable depression runs S.S.W. and N.N.E. for a distance of 50 miles, and is 3 to 5 miles in breadth within the 50-fathoms contour-line. The depths decrease gradually from 600 fathoms off the entrance to 20 fathoms at the head, at a distance of only 4 miles from the shore banks, towards which the water shoals rapidly.

On the east side, near the head of the Swatch, the 15-fathoms line is at a distance of 7 miles from the coast; it then takes a south-westerly direction to latitude 23° 18′ N., longitude 67° 22′ E. When it is 2 miles from

See charts, Nos. 118 and 42.

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the 50-fathoms line, and depths of 13 to 15 fathoms occur in the neighbourhood, it then turns to the eastward. On the west side, the soundings are from 20 fathoms at a distance of 15 miles, to 50 fathoms at 40 miles from the shore banks. The bottom in the Swatch consists of fine soft mud; on the eastern side, of coral, sand, and shells; and on the western of sand and stiff mud.

To use the Swatch as a guide to position, vessels should steer an E.S.E. or W.N.W. course, sounding across it, between latitude 23° 16′ N., and 23° 38′ N., then by plotting on the chart the soundings obtained on the east side of the Swatch, between 15 and 30 fathoms, according to distance, an approximate position will be determined.

KORI GREAT BANK, or the Sind-Kutch bank of soundings, extends 50 to 60 miles from the shore and has a depth of 20 fathoms at a distance of 60 miles south-west of Kori creek, thence it gradually shoals towards the coast, having soundings of 10 fathoms at about 20 miles off. On this great bank, to the east of the Swatch, there is a ridge of 13 fathoms, sand and shells, and there are other small patches of 12 to 13 fathoms, here and there, some even near the outer edge of the bank or 50 miles from the coast; outside the bank the bottom slopes down to the 100-fathoms contour-line at a distance of 80 miles from the shore.

The Baghiar is the southern mouth which discharges fresh water; it can only be entered at high water and in fine weather; inside, deep water of 3 to 4 fathoms is found in a narrow channel close to the left bank.

KEDIWÁRI MOUTH, in latitude 24° 2′ N., longitude 67° 22′ E., was, until 1819, the main branch of the Indus, discharging the greatest body of fresh water; the position of the mouth altered during the inundation of 1848, and in 1877 was not navigable. It is now (1895) once more the principal mouth for country vessels proceeding to Keti bandar. The entrance is narrow and shoal, there being but one or 2 feet on the bar at low-water spring tides. The channel is marked by bush beacons, and a pilot boat painted red is stationed inside the bar, to show vessels the channel when necessary. A good channel for country boats leads to the town of Keti.

Tides.—It is high water, full and change, at Kediwári mouth at 10 h. 19 m.; springs rise 9 to 10 feet. The first part of the ebb runs south-easterly, but as the mud flats uncover, the direction of the stream changes through South to N.W., and runs parallel to the coast. The tidal streams, especially the ebb, are strong in the river up to Keti, running in some parts about 5 knots an hour; they are also strong for several miles outside the bar. On the ebb the surface of the sea is fresh at a distance of

See charts, Nos. 42 and 118.

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4 or 5 miles off, when the river is high. During the ebb there is a heavy break on the bar with a fresh sea breeze.

When the sun has south declination the night tides rise higher than the day tides, the flood is weak in the daytime, and the ebb continues to run two hours after low water with considerable strength.

Each year during the floods of the Indus great changes occur; therefore vessels passing along the coast in this vicinity should not approach by day nearer than a depth of 10 fathoms, or by night into less than 15 fathoms.

At the time of the last survey (December 1894) the 5-fathoms contour-line was about one mile, and the 10-fathoms line 6 miles, from the shoal ground extending off the mouth of the river.

The breakers or surf, although indicating approximation to the shore, are no certain guide; at times landing may be effected, at other periods the breakers are heavy, and may be seen and heard for some distance.

Hajamro mouth.—The Hajamro was, in 1867, the fresh water and only navigable mouth of the Indus; it had, however, between that date and 1877 extended $3\frac{1}{3}$ miles to the seaward. Having become closed, this branch was abandoned by the country shipping.

Hajamro beacon, situated $3\frac{3}{4}$ miles north-west from the present (1895) Kediwári mouth in latitude 24° 4½′ N., longitude 67° 20′ E., is 90 feet high, in the form of a tripod with a cone-shaped frame on top, and is a good mark on a clear day. Mangrove bushes may be seen in the vicinity, and in clumps as far north as Karp creek.

KETI is the only town near the mouths of the Indus; it stands on the left bank, 8 miles from the Kediwári mouth, and has a population of about 2,000. It is a depôt for merchandise, where firewood, grain, &c., are transhipped from flat-bottomed river boats to seagoing craft. The town is surrounded by a low mud wall or bund, to prevent inundation during the floods of the river. Boats trading between Keti and Karachi generally use the Sisa mouth; otherwise the Kediwári is the principal approach. Between Keti and the coast are several small villages, each stockaded and surrounded by mud walls to keep out the high tides. The country is very low and swampy; but horses, cattle, and sheep are bred here, and are protected at high-water springs, inside the stockades.

Trade.—The value of the exports from Keti in 1896-7 was 1,194,980 rupees; of the imports, 321,624 rupees.

The number of vessels that entered Keti in that year was 918 of 31,272 total tonnage.

The COAST between Hajamro mouth and Manora point is low, and intersected by numerous channels and creeks, which afford safe though

See chart, No. 41.

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rather circuitous communication between the main river and Gisri bandar at all seasons; these creeks are only used by country craft. As none of the mouths of these channels are navigable except by vessels of very light draught, and, moreover, are subject to annual changes, it is unnecessary to describe them at much length.

Sisa (or Juna) mouth.—Between Hajamro beacon and Sisa mouth, 8½ miles to the northward, there are many inlets from the sea; the whole country for some distance inland covers at high water, and is intersected by creeks. The only opening used by boats, Karp creek, is (1894) marked on each side of the channel with small bush beacons.

In Sisa mouth, the water is fresh at low water during December. The entrance, which is narrow and difficult to find, has only 3 feet on the bar at low water springs, and breaks right across with the sea breeze; the channel is marked by small bush beacons. It is liable to change each year during the floods. The principal tributary is the Bhuri creek, which is deep and navigable for boats. The Gabri creek is navigable at high water only, and leads to the town of Keti.

The Sisa creek itself is only navigable at high water, when 6 to 10 feet may be obtained. The Richal creek is now dry at the mouth.

Banks of hard sand and mud extend nearly 3 miles from the coast at Sisa mouth, and two small islands, each half a mile in extent, which show just above high-water springs, lie 1¾ miles north of the present Sisa mouth.

Pilots.—A pilot boat, painted red, is stationed at the junction of the Bhuri and Gabri creeks.

Dubba creek.—The coast between Sisa and Dubba creeks is composed of low sand-hills 6 to 8 feet high, with tufts of grass on them. The bar off Dubba mouth has only a depth of 4 feet at low-water springs, and with a sea breeze is not navigable by boats. Inside the river the deep water lies along the north bank. A sand-hill 15 feet high lies 1¼ miles north of the mouth.

Pitiani creek is one of the most accessible, and is better defined than many of the creeks; by steering a south-easterly course across the bar to the mouth (when the 15 feet high sand-hills will be nearly ahead) a depth of not less than 1¼ fathoms will be found at low-water springs; but care must be taken to avoid the spit of sand which projects three-quarters of a mile to the southward from the north entrance point. The tributaries are deep and navigable.

Khai (or Kai) creek.—The mouth is shoal and narrow at the entrance, and difficult to find from seaward; inside, the creek is deep and navigable for boats. A spit of sand, dry at low-water springs, projects to the north-west for 1⅔ miles, from the south entrance point of the creek.

See chart, No. 41.

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There is no land-mark for the entrance, the latter being only ascertained by close observation of the breakers on a calm day. The bar has 4 or 5 feet upon it at low water springs; inside the mouth there are depths from 2 to 7 fathoms.

Between Pitiani and Khai mouths there are two creeks with shallow bars, which are small and insignificant.

Kudi mouth has 1½ fathoms on the bar at low water; a sand and mud flat extends north-west from the south entrance point, narrowing the width of the mouth to half a mile. To enter the creek, steer in with the easternmost sand-hills on the north shore bearing N.E. by E., and follow the north bank into the creek. A wooden beacon, 10 feet high, marks the south point of entrance. The sand-hills near the mouth are from 8 to 12 feet high.

Fishermen frequent these creeks during the fine season, erecting temporary huts during their stay.

The Juts, a migratory race, who graze their camels in different parts of the delta, not unfrequently bring fresh water from the mouth of the Kediwári. When no wells are near, or if they become brackish, the water is conveyed in the boats in bulk, and discharged into mud-bunds or reservoirs near their huts; this water serves for cattle and domestic purposes.

Piti is one of the largest, the deepest, and best defined of these several mouths. The bar, which lies 3½ miles from the mouth of the creek, has 4 to 5 feet on it at low water. To cross the bar, get the sand-hills (north extreme) on the south side of the mouth to bear E. by N. ½ N., and steer in on this course, keeping close to the south shore until inside, when turn to the northward.

The tides are strong, especially the ebb, which during spring runs about 3 knots.

Gisri mouth is shoal, there being about 5 feet, and the sea breaks across the entrance at low-water springs; inside there are depths of 3 to 4 fathoms. On the southern shore there are sand-hills 8 to 12 feet high, and 2 miles inside the mouth a sandy bluff 30 to 40 feet high, the country behind rising to Brahim Hyder.

Beacons.—Numerous wooden beacons, some 40 feet high, for the use of the survey have been erected along the coast described, and their positions have been shown on the chart; but owing to the changes in the direction of the creeks, and the strength of the S.W. monsoon, they are liable to be washed away or thrown down, and no reliance should be placed on them.

See chart, No. 41.

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Ruins.—On the left bank of the J'hiri are the ruins of a strongly built fort and town; also, on the right bank of the Rahu, one of similar construction, named Lohari; this is concluded to be the Lohari mentioned by Captain Hamilton, who landed at a bandar of that name, on his visit to Tatta, about the middle of last century. Native tradition bestows very ancient date upon these ruined edifices; judging, however, from present appearances, it is not believed they have any great claims upon antiquity.

The bricks are very similar to those made in the country at the present day, and the buildings are of a square form, with sides about 120 yards in length, that have three bastions on each face. From the mass of ruins, several copper coins of various shapes have been collected, all apparently of barbarous origin. These places, no doubt, flourished upon the main arm of the Indus, falling into decay as the river assumed a more eastern course.

The Swamps of the Lower Indus are less productive, in the way of obnoxious reptiles and quadrupeds, than most large deltas; and beyond a few prowling jackals and hyenas little exists. In the cold season myriads of ducks, geese, and other water-fowl are seen in the neighbourhood of the fresh-water mouths.

The salt-water worm (Teredo Navalis) is destructive, in a most extraordinary degree, to the bottoms of boats, timber, &c. In the short space of six weeks, it was found that they had penetrated teak plank fully half an inch. So well aware of this are the fishermen that they lay their boats aground every ten days, for the purpose of coating their bottoms with fish oil, which is considered by them a good protection.

The COAST between Gisri mouth and Manora point, at 5 miles north-west of it, recedes and forms a shallow bay with a sandy beach; about midway along this beach, and a short distance inshore, there are low table-hills, having on them some buildings named Clifton and Gisri. In the western part of this bay lie the Oyster rocks or islets, from the southernmost of which, 86 feet high, the flagstaff near Manora lighthouse bears W. by S. ¼ S., and is a little over one mile distant.

KARACHI HARBOUR (Kurrachee) is formed on the west by Manora breakwater, Manora point, the low sandy isthmus connecting the point with the mainland, and Baba island; on the east by Kiamari island, and the groyne or pier extending from it nearly 1¾ miles in a S.S.E. direction. The width of the harbour varies from 3½ to 5 cables, and its extent (1896) is 216 acres, with a depth of 20 feet and upwards at low water; besides a considerable area of shoaler ground, used by native vessels. Its length is somewhat over 2 miles from the Entrance channel

See plan of Karachi harbour, No. 40.

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to Kiamari, opposite which there are five creeks; four of these creeks run into a large backwater, occupying a space of 18 square miles, and extending 8 miles within the coast line north-westward of Manora; these creeks are only frequented by fishermen and boats to cut wood.

The remaining creek, named New Channel West, runs beyond Kiamari for 1½ miles to the native jetty, at which some of the produce is landed and shipped. This channel, 150 yards wide, receives through the opening in Napier mole, the water which formerly escaped by Chini creek, and was named New Channel East.

The opening in the Napier mole at the junction of the New East and West Channels is 400 yards wide, and spanned by a pile bridge. At the west end of this bridge there is a boat wharf named Napier Mole boat wharf, approached by a channel (leading from New Channel West) 1,900 feet long, 100 feet wide, and 12 feet deep.

Manora point is a low hill of soft sandstone capped with conglomerate, 100 feet high, terminating seaward in a perpendicular cliff protected with stone pitching; it slopes to the northward for half a mile, where it meets the sandy ridge joining it to the mainland. On the top of the cliff is a battery, and from the foot a breakwater extends in a S. by E. direction for 500 yards into 5 fathoms water. To the northward of the battery there are a few buildings, including the house for the Port Engineer, a small church for the convenience of residents and seamen visiting the port, the Lighthouse, the Port Officer's residence, and the house of the officer in charge of the Submarine Mining Defences.

From the base of the hill to a point half a mile further north, where the land narrows into two sandy strips, the space is taken up with the buildings of the Port Department staff, Telegraph buildings, Port Engineer's buildings, Military works, coal depôt, &c. The western sandy strip, which is from 10 to 15 feet above the sea, extends nearly straight to the north-westward, forming the west sea beach, and connects Manora with the mainland; while the eastern one forms the west shore of the harbour, and terminates opposite Kiamari, at the entrance of Tullah creek.

Baba, a sandy islet on the opposite side of Tullah creek, has on it a fishing village and coal stores. Northward of Baba islet is a great extent of banks and swamps, all flooded at high water and intersected by large creeks, the largest of which trends round the north side of that islet, and runs for several miles in a W.N.W. direction. The mainland, distant 2½ miles from Baba, is low and trends nearly east and west as far as Layari river, which is a watercourse with water only after rain, close northward of Karachi town.

See plan of Karachi harbour, No. 40.

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LIGHTS.—Near St. Paul's church on Manora point stands a circular tower, white to seaward, 91 feet high, from which, at an elevation of 148 feet above high water, is exhibited a *fixed white* light, visible seaward from N. 56° W. to S. 56° E., which should be seen in clear weather from a distance of 20 miles. In the hazy weather, prevalent during the south-west monsoon, it is generally visible from 10 to 15 miles only.

A *fixed red* light is shown from an elevation of 50 feet on the outer end of the breakwater, and should be visible from a distance of 5 miles; during the south-west monsoon it can only be seen about half that distance.

Position. — Manora lighthouse is in latitude 24° 47′ 37″ N., longitude 66° 58′ 36″ E.

CAUTION.—An electric light is used for working vessels alongside the Merewether pier and Erskine wharf; it is situated 1¼ miles north of Manora lighthouse, and can be seen from the westward for a distance of about 15 miles; care is therefore necessary when approaching Karachi not to mistake this light for the *fixed* light on Manora point.

Kiamari island is a low sandy ridge 10 to 15 feet above high water, and nearly 2 miles long east and west. On its west side is the landing place for all passengers and goods intended for Karachi, alongside piers and wharves where vessels can moor; hack carriages and carts are at all times procurable for conveying passengers to Karachi. Kiamari is connected by the North-Western and the Sind Railways, with the town of Karachi. It has also Government Commissariat store-yards, a post office, and customs offices. The bazaar at Kiamari is small and the supplies limited, the shipping in the harbour being generally provided from the cantonment market and the Sadar bazaar.

Harbour channel.—The entrance over the bar between the 20-foot contours (1897) is 2¾ cables broad; but the navigable channel, which lies between the red and black buoys, is, at its narrowest part, only one cable in width. Blasting and dredging operations are still in progress.

Buoys.—The channel is marked on the east side by 6 red conical buoys, which at night show *red* lights; and on the west side by 4 black can buoys, which at night show *green* lights. No light is exhibited from the outer black buoy during south-west monsoon.

The outer of these red buoys is moored nearly on the line of leading marks, in 18 feet water, with Manora lighthouse bearing S.W. ¼ W., distant 3 cables, and East pier beacon E. by S. The outer black buoy is moored in 20 feet water, with the breakwater light bearing S.S.W. ½ W., distant 2¾ cables, and the fort flagstaff W. ½ N.

In addition to the above channel buoys, a red conical buoy (not lighted at night), marking the southern limit of the port, is moored in a depth of

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See plan of Karachi harbour, No. 40.

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22 feet at low-water spring tides, with the extremity of the breakwater bearing West, distant $3\frac{1}{3}$ cables. This buoy is withdrawn during the south-west monsoon.

Leading marks.—Two channel beacons (northern on Kiamari island and southern on Kiamari groyne) in line, bearing N. 16° W. lead through the channel over the bar; these beacons are wooden structures painted black, with white marks at the top. There is also a beacon on East pier at $2\frac{4}{10}$ cables from its southern extreme.

During the south-west monsoon, from about 15th June to 15th September, and whenever it is impossible to light the outer black buoy, the leading marks will be lighted. The inner beacon will then show two red lights, one above the other, 22 and 30 feet above the sea; the outer will show one green light at an elevation of 20 feet. All three lights should be visible from a distance of 3 miles, but the lower red light of the inner beacon is reported to be not clearly visible, until a ship is well inside the harbour.

Navigable depths.—The depth of water in the entrance channel is at high-water mean springs $32\frac{1}{2}$ feet, and at mean neaps 29 feet.

During the south-west monsoon the maximum draught allowed for entering or leaving the port is 26 feet; and during the fair season 28 feet. At neap tides during the south-west monsoon, the draught allowed is regulated by the state of the weather.

Vessels drawing not more than 20 feet can enter or leave the port at any state of the tide at night; and at high water steamers of 26 feet draught can do the same.

Morris rock.—A small pinnacle rock of soft sandstone in the centre of the harbour, with a depth on it of 23 feet and 27 to 40 feet close around, lies N.N.E. 3 cables from Manora church, and E. by S. $\frac{3}{4}$ S. $3\frac{1}{4}$ cables from the end of the port office pier.

Deep water point rock.—Abreast Morris rock there is a rocky patch which sometimes dries, situated three-quarters of a cable from the western shore of the harbour at about half a mile north of Manora point.

Anchorages.*—In Karachi harbour there are four anchorages for large vessels, Deep Water, Manora, East Channel, and Kiamari.

Deep Water point anchorage has one swinging mooring, with a depth of 22 feet, at a radius of 400 feet.

Manora anchorage, between Deep Water and East Channel anchorages, has four swinging moorings for vessels drawing from 19 to 22 feet water.

East Channel anchorage has six moorings (head and stern) for vessels drawing from 22 to 24 feet water, the two southernmost being used by mail steamers.

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* Vessels' bottoms, especially those of iron, foul very rapidly in Karachi harbour, and the teredo worm is very destructive to wood which is exposed to salt water.

See plan of Karachi harbour, No. 40.

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Kiamara anchorage is used for vessels proceeding alongside Merewether pier and Erskine wharf.

Merewether pier has a depth of 26 feet alongside at low-water springs, and is provided with one 30-ton and eight 35-cwt. movable hydraulic cranes. On the railway jetty there are 20-ton sheers.

Erskine wharf has a depth of 22 to 26 feet at low-water springs, and is provided with one 12-ton and twenty-three 35-cwt. movable hydraulic cranes.

James wharf, a continuation northward of Erskine wharf, has also a depth of 22 to 26 feet alongside at low water, and is provided with one 12-ton and twenty 35-cwt. movable hydraulic cranes.

Merewether pier, as also Erskine and James wharves, are lighted by electricity when vessels are worked at night.

Between Erskine wharf and Merewether pier there is a passenger and a government pier.

Time signal.—A time ball is dropped daily (Sundays excepted) at the Merewether pier clock tower. The ball is hoisted close up as preparatory at five minutes before signal, and dropped at 1 h. 0 m. 0 s. p.m. Karachi mean time, equivalent to 20 h. 32 m. 8 s. Greenwich mean time.

Should the signal fail at 1 p.m., the ball will again be dropped at 2 h. 0 m. 0 s. Karachi mean time, equivalent to 21 h. 32 m. 8 s. Greenwich mean time.*

KARACHI, the capital and seaport of the province of Sind, lies 4 miles N. by E. of Manora point, and on the north side of New Channel East. The native town (the part nearest the harbour) is closely built and crowded; the new city contains many fine buildings, the most noticeable of which from seaward are Trinity church tower, the Scotch church, and Frere hall.

Population.—The population of Karachi (1891) amounts to 105,199.

Trade.—During the year 1896, the number of steam vessels that left the port amounted to 495, with a net tonnage of 596,277; and one sailing vessel of 500 tons.

The previous year's totals were 551 steamers of 669,159 registered tonnage, and two sailing vessels of 1,034 tons.

Exports.—The principal exports are cotton, wool, oil-seeds, wheat, hides, drugs, silk, &c., also horses from the interior. In 1896-97 the total value amounted to 58,072,345 rupees.

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* The time ball is dropped by hand, the time, which cannot always be depended upon, being obtained from sights taken by the pilot on duty.

See plan of Karachi harbour, No. 40.

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Imports consist of piece goods, cotton twist, metals, sugar, spices, silk, tea, liquors, grain, dried fruits, and salt fish, the latter chiefly for export to China; also plant for railway purposes. The aggregate value of imports in 1896–97 was 72,730,049 rupees.

The fisheries are extensive, and the fish of excellent quality; there are about 900 fishermen.

Supplies.—All necessary supplies and very good water are obtainable at Karachi. The Port steam water-boat supplies water to vessels in the harbour at a charge of 1½ rupees per tun; while vessels at Merewether pier and at Erskine and James wharves are supplied direct from the Municipal island pipes, at one rupee per tun.

Hawsers, warp-boats, and anchors can be obtained on application to the Port officer.

Coal.—The average quantity of coal kept in stock by the principal firms, aggregates about 2,000 tons, but no dependence can be placed on there being a supply in the market. Coaling is performed by lighters.

Dock.—There is a small dock at Manora with a depth of 10 feet on the sill at high-water ordinary springs; length 167 feet, breadth of entrance 32 feet.

Repairs.—Large general repairs to hull, engines, and boilers of vessels can be effected.

Steam tug.—A powerful steam tug is maintained at Karachi.

Life-boats.—There are four life-boats maintained at Manora.

Tides.—It is high water, full and change, at Manora point, at 10 h. 19 m.; springs rise 9½ feet, neaps rise 5 to 6 feet.*

The time of high water at Kiamari is about 10 minutes later, and at the native jetty, Karachi, from 20 to 30 minutes later than at Manora.

The ebb stream sets fairly down the new channel until abreast Merewether pier, where it is diverted slightly to the south-east and runs fair down the new channel to Deep Water point anchorage. Here it attains its greatest velocity of 3¼ knots (at springs) and is partly diverted, a small portion crossing the anchorage towards the end of Kiamari groyne, the main body of the stream setting fair through the entrance channel at a maximum rate of 2 knots. The ebb setting out of Baba and Tullah creeks follows the west side of the harbour.

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* The tides at Karachi are subject to a large diurnal inequality, which may either accelerate or retard the times of high water, sometimes to the amount of an hour and a half or two hours, and increase or diminish the rise by a foot or more.—*See Tide Tables for the Port of Karachi, published by the authority of the Secretary of State for India.*

See plan of Karachi harbour, No. 40.

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The flood sets at the rate of 2 knots across the end of the breakwater and round into the harbour; on the bar it still sets to the eastward at the rate of about one knot across the channel, but after passing it, sets fairly up the harbour. The greatest strength of the flood in the entrance channel is $1\frac{3}{4}$ knots.

In the outer anchorage the flood sets to the eastward, and the ebb (which is hardly perceptible $1\frac{1}{2}$ miles off the entrance) to the westward.

Pilots.—There are five pilots attached to the port who board vessels bound for the harbour, at a distance of about 2 miles from the entrance.

From about the 15th June to the latter end of August, pilots are seldom able to board vessels outside at night, but whenever a pilot can board, a green light will be shown over the platform of the Manora lighthouse.

Mail steamers arriving off the port at night should burn two blue lights in quick succession; other vessels should burn one.

A government Port officer is stationed at Manora, who controls the berthing and movements of the shipping.

Communication.—Karachi is in direct communication with Europe by eight regular lines of steam vessels, namely:—Hall, and MacIver of Liverpool; Messageries Maritimes de France of Marseilles; City of Glasgow; Bombay and London (Mogul), and Gray Dawes of London; the Wilson line of Hull; and the Hansa of Bremen. At least one vessel of each of the above lines leaves Karachi once a month.

The British India Steam Navigation Company run a weekly steam vessel to the Persian Gulf and Basra, and their mail and coasting steam vessels maintain a tri-weekly communication with Bombay, and bi-weekly with the Kutch and Kathiawar ports during the fair season.

Storm warning signals.—Signals are exhibited at Manora signal station on intimation being received of foul weather in the Arabian Sea, and likely to affect vessels at Karachi on leaving the port.

Cautionary signal.—The square flag W of the International Code hoisted on the lighthouse staff, indicates the existence of disturbed weather off the west coast of India near the port, or the advance of a cyclonic storm across the peninsular from the bay of Bengal.

For details of signals, *see* page 56.

Anchorage in the Road.—Vessels should not anchor off Karachi from June to the middle of September, but stand off and on, keeping the lighthouse bearing from N.N.E. to N.E., one to 2 miles distant, until boarded by a pilot or directed by signal.

From September until the end of March vessels may anchor with the lighthouse bearing N. by E. to N.N.E., distant one mile from the shore,

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in 6½ fathoms water; and during the months of April and May, about half a mile further off shore in 7 fathoms, with the lighthouse bearing from N.N.E. to N.E.

GENERAL DIRECTIONS.—The coast of Sind should be approached with caution; and attention paid to the lead, more especially in passing the banks of the Indus.

Approaching Karachi from the southward, land is not generally seen before making Manora point. When from the westward, the first landfall may be the sharp ridge of even outline, 770 feet high, which terminates at Ras Muari (cape Monze); this cape should be passed at a distance of at least 4 miles. During the south-west monsoon, sailing vessels should keep well to windward if the weather be thick, or if the tide should not suit for entering the harbour; making allowance for a strong set to the south-east, which prevails more or less during that season. Near Manora point a vessel may stand into 10 fathoms. If to the southward of the port, do not shoal under 8 fathoms, or bring Manora lighthouse to bear northward of N. by E.

The coast line southward of Karachi consists of low sandy ridges, with tufts of grass, hardly above the highest sea level, and not visible at more than 5 or 6 miles.

Great alteration of the banks off the fresh-water mouths is in constant progress, and a near approach to them must be made with caution. The banks, especially near the mouths, consist generally of soft mud, with ridges of hard sand in some places.

By day, the break on the edge of the banks is generally sufficient warning, except the water is quite smooth. In clear weather, the low shore, the isolated huts, or one of the beacons will be seen. The discolouration of the water is very marked, especially off the fresh-water mouths; it extends far outside the edge of the shoals.

By night, the banks should not be approached nearer than 15 or 20 miles; for at 7 miles outside Hajamro beacon, there is a depth of 10 fathoms, while at the head of the Swatch, there is about 20 fathoms at a distance of 5 miles off the banks, and here the water shoals rapidly to the 5-fathoms line.

Proceeding southward from Karachi, after deepening to 12 fathoms on a South course from Manora point, keep along the coast in that depth steering about S. by E., until the water deepens in the Swatch; a vessel will then be southward of all dangers. In the south-west monsoon it is desirable to give a wider berth, especially in a sailing vessel, and not to shoal under 15 fathoms.

See chart, No. 41.

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Vessels bound northward should steer to give the banks a berth of about 15 to 20 miles, in passing them at night. If, after crossing the Swatch, not less than 20 fathoms be obtained, a vessel may steer for Karachi, being careful not to shoal to less than 15 fathoms until Manora light is sighted.

The in-draught of tide into the rivers is only felt when close in ; the flood setting N.E. to E.N.E. and ebb S.W. to W.S.W., from half a knot to one knot an hour, at springs.

In the near neighbourhood of Karachi little current is found beyond the harbour tides. There is a slight set throughout the year to the south-eastward past the Indus banks; but from February to the end of the south-west monsoon, this south-easterly current is strong, and may be expected to run at the rate of from 15 to 45 miles a day.

CAUTION.—Several vessels have grounded on the Indus banks through not making due allowance for the south-easterly set above mentioned, and neglecting the use of the lead.

Outward bound in the south-west monsoon, it is advisable to work off to the W.S.W., for about 10 miles from Manora point, before steering a course to the southward, to avoid being set in towards the mouths of the rivers.

A steam-tug is required by sailing vessels leaving Karachi during the south-west monsoon, which, however, seldom blows hard in the vicinity of the port. The general direction of the wind is West to W.S.W., liable to squalls from north-east and south-east, with rain, particularly in July.

The COAST between Manora point and cape Monze is low and sandy for some distance, forming a bay ; it then becomes rocky for several miles, and is backed by a range of hills of about 770 feet elevation, which terminate at the cape.

Dangey patches.—To the south-west of Manora are several patches of sandstone rock extending in a north and south direction for about half a mile. The southern point of the patches bears S.W. by W., distant 1½ miles from Manora point; the least depth found on them is 5½ fathoms.

Patches of rock with 27 to 29 feet lie south-westward from the end of the breakwater, distant one to 1½ cables.

A shoal, with a depth of 5 fathoms on it, lies 2¾ miles off shore, with Manora lighthouse bearing E. ⅛ N., distant 8¾ miles ; foul ground extends from this shoal in a N.N.E. direction to the shore.

Nancowry shoal, with a depth of 4 fathoms on it, lies with the west extreme of cape Monze bearing N. by E. ½ E., distant 2 miles;

See chart, No. 41.

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from this shoal depths of less than 10 fathoms extend S.W. for a distance of 1½ miles.

Beauchamp reef is a coral patch, with a depth of 5 fathoms on it at low-water springs; it lies with the west extreme of cape Monze bearing East, distant 3½ miles; foul ground, with depths of 7 to 9 fathoms, extends S.S.E. for a distance of half a mile, and N.N.W. one mile, from Beauchamp reef.

CAUTION.—To avoid these shoals, vessels should not pass at less than 4 miles from cape Monze, and should keep Manora point light bearing northward of E. by N. until well past them.

RAS MUARI, or Cape Monze, situated 17 miles west of Manora point, is a bluff headland from which the mountain range gradually rises to the north-east.

Churna island, situated 4 miles north-west of cape Monze, consists of a sharp ridge of light-coloured limestone hills, 580 feet high.

The soundings at about 30 miles west of cape Monze deepen suddenly from 60 to 100 fathoms, the bottom being mud except in depths under 20 fathoms, south-west of the cape. Outside the 10-fathoms line of soundings, off Karachi, the bottom is all mud, until between 35 to 45 miles south-west of that port, when the soundings range from 30 to 40 fathoms, sand, shells, and coral.

See chart, No, 41.

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CHAPTER X.

MALDIVE AND LACCADIVE ISLANDS.

VARIATION, 1° 0′ W. to 0° 20′ E. in 1900.

MALDIVE ISLANDS.—Channels.—Among the different atolls of the Maldive group there are several good channels, some of which are intricate, and should only be used by steam vessels, as the currents run strong through, eastward or westward according to the season. These channels are so deep that no soundings have been obtained in them, not even close to the outer edges of the islands and reefs.

Besides the channels which separate the different atolls, there are numerous openings through their exterior reefs which are also very deep. These openings are difficult to make out at a distance of 3 or 4 miles, the barrier appearing as one continuous line of reef to strangers approaching it; but no danger need be apprehended when the wind is steady, and by nearing them to the distance of one or 2 miles, the channels are distinctly seen with the sun in a favourable position. Within the atolls good anchorage may be obtained in very smooth water of moderate depth, bottom coral and sand.

By day, all the channels between the atolls, and even those amongst the islands and reefs, may be passed through without anxiety, as all the coral dangers under water are visible at some distance, from the mast-head.

By night, vessels ought only to pass through the four larger channels between the atolls, provided the entrance has been made before dark, or the latitude is accurately known.

ADDU ATOLL, the southernmost of the Maldive group, and the smallest of the southern atolls, is 10 miles long east and west, and 7 miles across; it is of half-moon shape, concave on the north side. This atoll is fertile, and contains over 900 inhabitants (1889). It has nine large and several small islands; the two principal are Hitadu and Midu (called also Huludu, both names being those of villages on the same island). Hitadu is the north-westernmost, and Midu the north-easternmost of these islands, and about midway between there are two openings into the atoll through the northern reef.

See chart, No. 66*c*.

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Gan is the southernmost island of the group, its east end lies 8 miles south-east of the north point of Hitadu, and on the same barrier-reef, which is dry at low water. Eastward of Gan lies Wilingili island on a separate reef, and on either side of it are the two best openings into the atoll, named Gan and Wilingili channels. From the latter a continuous barrier-reef extends northward to Midu, thence westward to the middle of the north face of the atoll.

Supplies.—The islands afford a few supplies of fruit, limes, poultry, and eggs. Water and firewood are plentiful. The natives are very civil and obliging, and will exchange the above-mentioned articles either for money, or rice, biscuit, sugar, salt, onions, and garlic. These people, some of whom can converse in Hindustani, are extremely lazy and indolent, very timid, and afraid of strangers; they are under the government of the Sultan at Mále island. The Atoluveri, or chief of the atoll, is the person to whom strangers should apply for assistance in obtaining supplies. Their principal occupation is making cotton cloths of white, red, and black colours mixed, all of which they dye, and sell at a good price to the other atolls. They are not allowed by their government to trade with foreigners, not even with the British, their allies; all their produce must be sold at Mále. They seldom visit passing vessels, from timidity, and those visiting these islands should not intrude into the privacy of their houses.

Passages into Addu Atoll.—There are four passages leading into this atoll; two on the north, and two on the south side.

The Southern openings are broadest and deepest, and with a fair tide a vessel could work through them; but it is better to adopt that opening through which the wind is fair. Gan channel is half a mile wide from 13 to 7 fathoms water. Wilingili channel, nearly 2 miles north-east of Gan, is one mile wide at its outer part, and has from 13 to 20 fathoms water, deepening inwards to 30 fathoms; the course through is about N.W., but as a vessel proceeds inwards care is necessary to avoid three coral patches in succession, on which the sea breaks at times.

The Northern openings are not so wide nor is that eastward of bushy islet so deep, they are, however, safe and available for vessels approaching from the northward with northerly winds, or leaving the atoll with southerly winds, but they are too narrow to work through. These openings are not easily seen by a vessel approaching from the northward, as the north side of the atoll appears like one unbroken reef; on a nearer approach, and almost central between the trees of Hitadu and Midu, there will be seen a small bushy islet and a high bank of coral on the same reef, which divides the two channels. The eastern passage is between 2 and 2½ cables wide, with not less than 6 and 7 fathoms water; its

See chart, No. 66c.

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direction is north-west and south-east. The western channel is narrower and longer, with depths from 19 to 21 fathoms.

Tides and Currents.—It is high water, full and change, at Addu atoll, at 1 h. 0 m.; springs rise about 4 feet.

In both northern and southern passages, the tides and currents are strong; the flood sets into the northern, and the ebb sets into the southern openings.

The currents in the vicinity of this atoll commence to set westward about January, and eastward about June, with a velocity of 40 to 50 miles a day, but subject to checks from variable winds. At a distance of about 40 or 50 miles from the islands they decrease considerably in strength.

Soundings.—No soundings have been obtained on the seaward sides of this atoll; but within there are depths of 30 and 35 fathoms in the centre, and 20 to 25 fathoms near the islands; the only detached reefs are a patch of 12 feet near Maradu island, and three patches on which the sea breaks at times, lying in the centre of the atoll between Wilingili and the northern channels.

Anchorage.—Near the west sides of the eastern islands a vessel may anchor in the north-east monsoon, and on the north-east sides of the western islands in the south-west monsoon, in smooth water; these are the most convenient anchorages for communication with the natives.

Winds.—Addu atoll is almost beyond the influence of the south-west monsoon, the winds and weather being very variable, subject to squalls and rain. The north-east monsoon is felt in January, February, and March.

FUA MULAKU ISLAND is situated near the centre of the Equatorial channel at 21 miles north-east of Addu atoll. The island is 2 miles long north-west and south-east, with an average breadth of three-quarters of a mile; the trees are from 70 to 90 feet high. It contains over 500 inhabitants (1889), who are principally employed in fishing and weaving cotton cloth. From these islanders may be obtained turtle, fowls, eggs, fruit, lime, firewood, and fresh water; they often visit passing ships which show their colours. Some of the natives can converse in the Hindustani language.

Fua Mulaku is steep-to on its north, east, and west sides where no soundings have been obtained; but off the south end a shelving bank extends for 1½ miles, on which the surf breaks heavily for a distance of three-quarters of a mile from the island on the south extreme of this bank, in moderate weather, anchorage may be obtained in 6 and 7 fathoms

See chart, No. 66c.

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water. The bank is composed of hard sand with small coral rock, and its sides, like the island, are precipitous.

EQUATORIAL CHANNEL.—By this name navigators in general know the entire passage between Addu and Suvadiva atolls at 46 miles north of it; but the island just described lies athwart the passage, about midway between Addu and the equator; so that Equatorial channel *proper* lies between Fua Mulaku and Suvadiva atoll. This channel is free from dangers; a sailing vessel passing through, from either east or west, ought with light winds to borrow towards Addu, to prevent, in case of calms and variable winds, being drifted too close to Suvadiva atoll; but should this occur during the daytime a vessel may easily enter one of the numerous openings leading into Suvadiva atoll.

Tides.—It is high water, full and change, at Fua Mulaku at 1 h. 0 m.; springs rise 5 feet. The ebb stream sets westward, the flood eastward; but are little felt except in retarding or accelerating the currents.

Winds.—The prevailing winds are from West, to south and S.S.E., from May to December, with much rain and squalls. In the latter month, the north-west monsoon (which prevails for nearly all the first half of the year from the equator to Chagos archipelago) commences with about a fortnight's hard squalls and fresh gales from West to W.N.W. with heavy showers of rain; but in January, February, and March the north-east monsoon blows to the equator, and sometimes to a short distance southward of it, the wind being generally in those months from north and north-east in the Equatorial channel, with less clouds and rain than in the last half of the year.

SUVADIVA ATOLL, called by the natives Huvadu, is one of the largest of the Maldive group, being nearly 44 miles in length north and south, by 34 miles in breadth. The islands on the boundary are numerous, but only fifteen are inhabited. There are thirty islands in the centre of this group, where a greater depth of water is found than in the interior of the other atolls, and it is also less obstructed by coral reefs.

The aggregate population of this atoll (1834–6) is about 2,000. The principal employment of the men is fishing; of the women, weaving mats of pretty patterns for couches, beds, &c., with rushes dyed of different colours. The island Gaddu, on the south-east side of the atoll, is the place where the mats are chiefly made. The inhabitants of this group are much subject to elephantiasis, a dropsical swelling of the legs.

Hondedu island, in lat. 0° 27′ N., long. 72° 56′ E., is situated near the west extreme of the group, at the north end of a barrier-reef,

See chart, No. 66*c*.

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which is 18 miles in length and forms the south-west side of the atoll. It is the residence of the Atoluveri, and contains about 200 inhabitants (1834–6); good water, poultry, &c., may be procured. In the westerly monsoon good anchorage may be obtained on the east side of the island in 27 to 35 fathoms water. Southward of Hondedu the barrier-reef is thickly studded with islands, which at a distance in some parts appear like one large island; there is a projecting elbow of this boundary reef off the island Nandalle, which is over 9 miles south of Hondedu; from Nandalle the reef trends in a south-easterly direction for more than 8 miles to Fiyori island, which terminates the south-west barrier; this island is inhabited, and has good water.

Matoda island stands on the southernmost coral reef of Suvadiva atoll, and is separated from Fiyori by an opening 3 cables wide, in which there is deep water, and through which the course is north and south. There are several small islets on this coral reef, the eastern end of which, dry at low water, projects more than 1½ miles beyond the islands; round this there is a good passage about half a mile wide, leading into the atoll about N.N.W. and having not less than 7 fathoms in its shoalest part.

Openings along Equatorial channel.—Along the south face of Suvadiva atoll, in a distance of 25 miles, there are nine passages leading into the interior; and, in case of being drifted near them, eight may be used to enter the atoll where anchorage may be obtained. Should the vessel not be able to pass out by the same openings, she may, in the daytime, steer boldly northward through the interior, in 35 to 45 fathoms water, passing occasionally some small coral islands and reefs which are easily seen from aloft, and proceed to sea by one of the opposite channels nearest her route. Some of the islanders will gladly conduct a vessel through for a few pounds of rice or bread.

Wahdu, situated on the reef next east of Matoda, is about 1¼ miles long east and west, and less than half that distance across; it was at one time a very fertile island, with a population of 1,200, but now contains few inhabitants. The island is worth visiting, the ancient mosques, burial places, and other parts being very interesting. Close round its east and north sides is a channel into the atoll on a West course. This passage is more than one mile wide, but shoal water with patches of 3 and 4 fathoms contract its northern part, so a vessel must keep well over to the Wahdu side, where depths of 25 and 40 fathoms are found: the shoal ground is, however, convenient to anchor upon when obtaining wood and water from that island. The tides are strong in this opening.

See chart, No. 66c.

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Between Wahdu and Gan channels there are three other channels amongst islands; the western leads in a north direction and is very deep; the other two lie in a north-west direction, with depths of 4½ and 6 fathoms.

Gan island, the largest of the group, situated 9 miles east of Wahdu, is 1½ miles long, and has on it several trees. On both sides of the island there are passages, but the eastern is narrow, and has only 2 fathoms water. The western, named Gan channel, is 1⅓ miles wide, with soundings of 30 fathoms throughout; entering this channel an island will be seen in the centre, which may be passed on either hand, but on its seaward side a considerable projecting reef extends towards the entrance. As the atoll is entered, several islets and reefs will have to be passed, but all are plainly visible from aloft.

Gaddu island lies about one mile from the north-east point of Gan, and is the southernmost of several islands which from a distance appear as one island; the reef is 5½ miles long, and its north-east island has plenty of cocoa-nut trees which mark the west side of Kanduholudu opening.

Kanduholudu is the south-easternmost island of the Suvadiva group, and in the opening half a mile wide on its west side, leading north into the interior of the atoll, there are depths of 7 and 8 fathoms; this passage is the easternmost of those that border on the Equatorial channel. From this island the barrier-reef trends northerly for 6 or 7 miles, with several islands on it, before another opening occurs.

Eastern openings.—There are nine entrances along the east face of the atoll, between its south-east and north-east points. The southernmost of these is in lat. 0° 28′ N. on the north side of Mavaru, and runs in a westerly direction towards a small island one mile within the atoll. Sailing vessels could only enter the eastern channels with a leading wind.

Diyadu and Kondai, at 9 miles north of Kanduholudu, are two inhabited islands where good water is obtainable; between them there is a narrow entrance with 17 fathoms water; a West course leads in, and a vessel may anchor on the west side of Kondai. There is an entrance, with 10 fathoms, at 3½ miles northward of Kondai channel; and another, with 8 fathoms, on the south side of Madu island at 2 miles farther north. On the north-west side of Madu there is an opening with a depth of 6 fathoms.

Nilandu island, situated 5 miles north-west of Madu, is inhabited, has good water and some supplies, with well-sheltered anchorage in the north-east monsoon; there are openings in the reef at either end of the

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See chart, No. 66c.

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island. Nilandu northern passage, near the middle of which there is a coral patch, leads into the atoll on a West course; the southern passage, with a depth of 13 fathoms, has a W.S.W. course. Northward of this island there is a reef 4 miles long north and south, having on it six islands; the northernmost, Mamendu, is inhabited, and has a passage with 13 fathoms water between it and Kubudu.

Wiligili lies half a mile northward of Kubudu, and between them there is a passage about 2 cables wide, but with 12 fathoms water; this is the northernmost of the five openings in the northern half of the eastern reef. Wiligili island has a few inhabitants, and stands on the south extreme of the 11 miles of impassable barrier-reef which forms the north-east boundary of Suvadiva atoll; near it are four small islets, then reef for 5 miles to Mamuta, the two small islands, which are generally first seen when approaching from the north-east.

North and North-west openings.—On its north and north-west sides Suvadiva atoll is bounded by many detached coral reefs, more irregular in position and outline than those already described; numerous safe passages exist between them, but, in adopting these, a careful look-out must be kept, as there are no islands on the northern verge of the reefs, though two or three lie about a couple of miles within the boundary at about 5 miles from Mamuta.

Mafurhi, the principal island at the north-west point of the atoll, 14 miles west of Mamuta (that being the breadth of the northern portion of the atoll), is inhabited, has good fresh water and plenty of poultry, &c. It stands one mile from the north point of its fringing reef, which extends also 4 miles to the south-east. Another island, about one-third the size of Mafurhi, and which shows conspicuously, lies about 1½ cables eastward of that island. Mafurhi entrance is one mile wide, but Wiligili islet in the centre, forms two channels; the western is shoal, with only 4 fathoms water, and the eastern has a depth of 34 fathoms. Some islets and reefs south and east of Wiligili must be avoided by a good look-out from the masthead.

Anchorage may be obtained in 10 fathoms water, with Mafurhi island bearing West, distant one mile. Vessels visiting it for supplies, if from the northward, should enter the atoll by one of its northern entrances, and then steer to the south-west and west, passing between some small islands towards Mafurhi.

Tides.—Near Mafurhi it is high water, full and change, about 1 h. 0 m.; springs rise 4 feet.

See chart, No. 66*c*.

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Deep bight.—Between Mafurhi and Havaru tinadu, at 21 miles south-west of it, the barrier-reef recedes and forms a deep bight, in which there are numerous openings leading into the atoll. This bight is dangerous for a vessel to drift into in calms and light winds. Along this part of the barrier-reefs, there are no tree islands, or conspicuous land-marks, but merely heaps of coral and sand, on only two of which are any bushes; but a vessel in extremity might run through one of the openings with a good look-out at the mast head. The best of the openings are on the southern side of the bight.

Havaru tinadu, the westernmost inhabited island of Suvadiva atoll, is about one mile in extent, contains about 200 inhabitants, and has good water and a few supplies. Approaching this island from the west or south-west it appears to be the most northern island of the atoll, owing to the absence of any tree-islands along the boundary which recedes to the north-east from this point.

Should a vessel bound into the atoll from the westward, be drifting into the deep bight to the north-east, it would be advisable, if possible, to enter by the small but safe channel at the south end of Havaru tinadu, where there is a depth of 6 fathoms, although the passage is not quite one cable wide; but its south bank is well marked by an islet with low bushes and a single cocoa-nut tree (1836). Southward of this islet there is another small entrance with a like depth of water.

Kandudu opening is the most convenient for vessels, and may be said to be the principal entrance into Suvadiva atoll. It is a good passage, three-quarters of a mile wide, with not less than 6 fathoms water. The centre of this opening is one mile north of Hondedu, but another island called Madaveli (uninhabited) intervenes and borders the south side of the entrance.

ONE AND HALF DEGREE CHANNEL, situated between Suvadiva and Haddummati atoll, at 51 miles north of it, is free from dangers. It is adopted by vessels from the Cape, bound to Ceylon in the months of October and November. Should a vessel, however, be drifted near either atoll and unable to pass clear, there are four or five openings into the north part of Suvadiva, and one large entrance near the south extreme of Haddummati.

HADDUMMATI ATOLL is 26 miles long north-east and south-west, and 15 miles across the broadest part. Its boundary-reef has six openings, four of which are available for large vessels. The interior of the atoll has numerous coral patches, all of which are discernible from the masthead, as a vessel approaches them on a clear day.

See chart, No. 66*c*.

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Mavarhu island, at the west extreme of the atoll, in latitude 1° 53′ N., is its principal island, where wood, water, and poultry can be procured. It contains between 300 and 400 inhabitants, and trade is kept up with Calcutta every year by three or four vessels of their own construction, of from 80 to 100 tons burden. The Mavarhu opening, situated 1½ miles northward of the island, is described by the surveyors as a narrow but safe channel, although no soundings are recorded. The course inwards is S.E., afterwards turning to the south and east, thence to the south again, and finally to the west, to avoid a horse-shoe reef which interposes between the entrance and the east side of the island, where good anchorage may be obtained during westerly winds, in 17 to 20 fathoms water. There are two islands on the north side of this entrance, which are used as places of interment for those natives who die on board their boats.

South opening.—From Mavarhu, a continuous barrier reef, with several islands, extends 11 miles to the south-east, and forms the south-west side of the atoll. Near the east extreme of this reef stand the islands Kunahandu and Hitadu, which appear like one island ; off the last-named the reef extends nearly three-quarters of a mile eastward, marking the west side of the South opening, which is 2 miles wide with deep water. Gadu island, which marks the east side of this opening, lies E.N.E. 2¾ miles from Hitadu. Three islands lie just within this entrance on the west side of the centre, and form two passages into the interior of the atoll; one leads in on a North course eastward of the islands; the other turns west between the north face of Hitadu and the three islands, after passing which several coral patches lie athwart the way, these are discernible from aloft on a clear day. Should vessels enter this opening in want of wood, water, and poultry, they should proceed through the atoll to Mavarhu island taking care to avoid the above reefs.

East openings.—From Gadu the sea-face of the boundary reef curves in an east, north-east, and north direction for 15 miles to another opening, and is thickly covered with islands. There is an opening on either side of Mabaidu island; the southern is the better of the two, having 8 fathoms water, while the northern has only 3 to 4 fathoms ; each has a width of 2 or 3 cables; a West course leads into both. Mabaidu and the two islands, which form the north and south sides of these openings, are inhabited.

Isdu Island, situated on the north-east extreme of Haddummati atoll, at 6 miles north of Mabaidu, is 2 miles long east and west, and

See charts, Nos. 66*b* and 66*c*.

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being well covered with cocoa-nut trees, forms a good landmark. There are several small islands on the reef between Mabaidu and Isdu.

North-west openings.—On the north-west side of this atoll there are two openings. The eastern, named Wadinu entrance, lies on the east side of the little island of that name, at 13 miles west of Isdu, it is about 2 cables wide, with depths of 10 to 17 fathoms. A reef 2 miles long separates Wadinu entrance from the western entrance, which lies on the east side of Munnafurhi islands, with generally not more than 3 to 3½ fathoms water. From the last-named islands the boundary-reef trends south-west for 5 miles to a projecting elbow, thence south 3 miles to Mavarhu entrance.

VEIMANDU CHANNEL, between Haddummati and Kolumadulu atolls, has a width of 16 or 17 miles throughout its length of about 25 miles north-east and south-west. Although this channel is safe, there would be less anxiety at night in passing through One-and-half-Degree channel.

Tides.—It is high water, full and change, in Veimandu channel, at 3 h. 0 m.; springs rise about 4 feet. Flood tide runs to the eastward, and ebb to the westward, with a velocity of about 2 miles an hour at springs: each tide is accelerated or retarded by the prevailing current.

KOLUMADULU ATOLL is of a circular form, its greatest breadth from east to west being 29 miles, and from north to south 24 miles. This atoll is principally surrounded by barrier-reefs, in which there are twelve openings. There are several islands along the southern boundary, but few along its north margin; and in the interior only six are found, these are near the west side. Numerous coral patches, dry at low water, lie within the atoll, but the general depths are from 32 to 42 fathoms.

Of the twelve entrances into this atoll, one is on the west side, four along Veimandu channel, and the rest along the north face of the atoll.

West opening.—This broad entrance lies between the two principal inhabited islands of the group, Hirilandu and Kandudu, which are 2¼ miles apart. The passage is nearly 2 miles wide between the barrier-reefs, with shoal water in the middle, and coral rocks visible below water, on which in some places the depth is only 2 fathoms; these may be avoided by borrowing towards either island, where the water will be found very deep. An island lies about one mile within the centre of this opening; and another northward of that and rather more than one mile to the east of Kandudu.

See chart, No. 66*b*.

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Supplies.—Hirilandu and Kandudu both afford good water, firewood, and poultry; a vessel may choose anchorage on the east side of either, according as the wind permits.

The South-west barrier-reef of this atoll extends from Hirilandu in a southerly direction 5 miles, thence curving in an easterly direction 9 miles to Veimandu, which is an inhabited island with good water, standing at the west side of the westernmost of the southern openings. There are several islands on the southern part of this boundary-reef; the south-westernmost group, named Furhi, is situated 5 miles S.S.E. from Hirilandu; the most southerly island, Kimbidu, lies 1½ miles W.S.W. from Veimandu.

South and East openings.—There are three of these convenient openings near the southern end of the atoll, formed by two islands which lie between the south-west and south-east barriers. The westernmost opening, between Veimandu and Kanimidu, is broad and deep for one mile in a north-west direction, when the passage is obstructed by a large coral reef, which compels a vessel to bear away to north or west, as the wind permits. The second opening is narrower, with 6 fathoms water; a vessel must, however, borrow towards the island Kanimidu to avoid some rocks which project from the little island on the east side of the entrance. The third opening is deep and safe, having 35 fathoms water between the last small island and Timarafurhi, which stands at the south-west extreme of the barrier-reef that borders Veimandu channel.

The East opening, at 13 miles north-east of Timarafurhi, has a depth of 8 fathoms, the intervening barrier-reef is thickly covered with islands. This opening lies between Guradu and Diyamigili.

The Eastern boundary of this atoll is a curved barrier-reef, about 15 miles long, without any openings. The island of Fahala, nearly 4 miles long north and south, and well covered with cocoa-nut trees, stands on this reef, and defines the east extreme of the atoll, for there are no soundings available half a mile from the island.

North openings.—Along the north face of this atoll there are several openings; those close to the east points of six straggling islands are said to be safe, though small, but there are only soundings recorded in three of them. The easternmost of these openings has 5 fathoms, and is situated 3 miles west of the island Wilifurhi, the north-easternmost of the group. The island Buruni marks the extreme north point of the atoll, and lies about midway between the north-east and north-west points. Buruni opening lies close round the east side of that island, and has 7 fathoms water. About midway between Buruni and the west point of the atoll are two other openings, one close to the east side of Kandufurhi island, the

See chart, No. 66*b*.

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other 1½ miles more to the west; both have plenty of water. Southward of these, along the west side of the atoll, there are no more openings for a distance of 15 miles, neither has this boundary-reef any islands for a distance of 11 miles to Weligandu island, at 4 miles north of the west opening.

KUDAHUVADU CHANNEL, so called after the island of that name, the southernmost of Nilandu atoll, is a narrow but safe channel. The west entrance of this channel is only 10 miles wide, it is well marked on the north by the island Kudahuvadu, but not so well on the south, where it is bounded by the north-west extreme of Kolumadulu atoll, which at its most projecting part has no islands or landmarks, except Kandufurhi island, which is nearly 5 miles within the entrance, and bears from Kudahuvadu island S.S.E. ¾ E., distant 10 miles.

The course through Kudahuvadu channel from the westward is E. ¾ N. for the distance of over 30 miles, between the southern islands of Nilandu and Mulaku atolls. The atoll on its south side shows a prominent point at the island Buruni. The tides in this channel, as in those already described, set, flood to the east, and ebb to the west.

Northward of this channel the atolls lie in double groups—east and west atolls—and, as the currents of the ocean are thereby more obstructed, they run through the narrow channels with greater velocity and uncertainty. The open space, nearly 20 miles in width, between the east and west groups, is, however, free from all dangers.

NILANDU ATOLL, the southernmost of the west atolls, is 40 miles in length north and south, and is divided into two atolls by a channel 3½ miles wide, with soundings of 200 fathoms; therefore, for the sake of clearness, the southern and northern groups will be separately described.

South Nilandu is of an oval form, 22 miles long north and south, and 13 miles across. Many passages admit of vessels entering the atoll, but on the south-west side it is not accessible. The general depths in the interior are from 27 to 35 fathoms. It is studded with several large and small coral reefs, some dry at low water, others having several feet of water over them, but all are steep-to and easily discovered. On the eastern boundary, islands are numerous, and in one part thickly grouped together, but the west side of the atoll has only two or three. In the interior there are about twenty islands, more than half of which are towards the north part, and upwards of 3 miles within the boundary. At Dures (Ribudu) island, which is about 5 miles north-east of the west

See chart, No. 66*b*.

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openings, a number of working jewellers reside, who travel periodically among the different atolls in pursuit of their calling.

Along the south side of South Nilandu atoll are three good openings; the first or westernmost is 1½ miles wide, with 9 fathoms water, close to the east of the island Kudahuvadu, which is inhabited, and affords some supplies of wood, water, and poultry; two small islands, at the west end of a separate reef, mark the east side of this opening. The second passage, one mile wide, with depths of 14 fathoms, is about midway from the above towards the south-east point of the atoll. The third, at the south-east angle between the islands Wani and Kandimma, is narrow and has 20 fathoms; a W.N.W. course leads in.

Kandimma, at the south-east extreme of the group, is the southernmost of twenty islands on one reef; from it the east side of the atoll extends in a northerly direction 17 miles, with seven good openings; the first is 5 miles north of Kandimma, and the rest at intervals of about 2 miles.

Furhi is the northern island on the east side of the atoll, and the northernmost of the above openings leads in on a S.W. course close along the south-east side of the island. From Furhi the boundary-reef trends in a westerly direction for 5 miles to the easternmost of the north-west openings, a wide channel with 17 fathoms water between barrier-reefs, but with no islands to point it out. The second and third of these openings are broader and deeper than the first, but, like it, have no islands or land-marks to distinguish them; they should therefore only be entered by vessels that unavoidably drift near them. As the reefs which separate these north-west openings have no islands, and the several islands whose trees are visible from a distance, lie more than 3 miles within boundary reefs, the north-west extreme of the atoll is unsafe to approach.

There are two good entrances on the south sides of Madali and Huludali, two inhabited islands near the middle of the west side of the atoll; an E.N.E. course leads into the northern opening, which, being between the two islands, is better defined than the other, and has 19 fathoms water. An E.S.E. course leads into the southern, which has nothing but the point of the long barrier-reef to mark its south side.

North Nilandu.—The eastern side of this atoll curves to the eastward, but its west side is nearly straight. There are not many islands on its boundary; only one on the west, one on the north, one at the south extreme, and the rest rather equally distributed around the eastern reefs. In the interior, where the general soundings are 25 to 35 fathoms, there are four islands and several large coral reefs dry at low water.

See chart, No. 66*b*.

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Nilandu, the southernmost island of the northern group, is inhabited, and affords some supplies and good water. On its east side is situated the southernmost opening into the atoll, one mile wide, and with 20 fathoms water; a course between N.N.W. and North will lead in. The barrier-reef, at the south point of which Nilandu stands, extends more than 4 miles in a north-west direction, and has a wide and deep passage into the atoll along its north end. On the north side of this passage there is a circular lagoon-reef, north of which there is another passage, narrow but deep; thence to Himiti south opening there is a barrier-reef, having a sea-face of more than 6 miles.

Himiti, the western island, though small, is important; it has high trees, and contains (1834–6), between 200 and 300 inhabitants who are traders and navigators, sending annually to Bengal five or six vessels of 80 or 100 tons burthen. They have a large school for instructing native youths in navigation, and they make some of their own nautical instruments. The fresh water of the island is bad. It is said that the sea has for several years been gradually reducing the size of Himiti.

There are openings into the atoll on both sides of Himiti. That on the south is more than half a mile from the island, has 6 fathoms water, and takes an E. by N. course inwards towards another island which faces the entrance, and may be passed on either side. The opening on the north of Himiti has 13 fathoms water and takes an E.S.E. course along the face of the reef which projects 1½ miles north from that island.

A clump of cocoa-nut trees on a small island marks the north end of the atoll; there is an opening with 15 to 20 fathoms water upwards of one mile from its west side, and another broad opening on its east side, with a reef in the middle. From this last opening, round the eastern boundary to the south point of the atoll, there are other openings at distances of one to 4 miles; some are very narrow, but all, with the exception of the narrow passage southward of Hura, have a tolerable depth of water.

MULAKU ATOLL, situated about 20 miles eastward of the Nilandu group, and 15 miles north-east of Kolumandula atoll, is of irregular form along its east face, the north-east and south points being very prominent; whilst its west boundary is straight in a north and south direction for 25 miles.

The atoll contains twenty-one islands, ten of which are inhabited, and together have a population of 980; all are on the boundary reefs, except Mulaku, the largest, which is nearly one mile within the principal entrance on the east side of the atoll. In the interior there are many coral patches, and the depth of water is from 28 to 40 fathoms on a sandy bottom.

See chart, No. 69*b*.

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At the south end of the atoll there is a cluster of six islands, two of which are inhabited and possess good water, but landing can only be effected on the inner sides. The nearest entrance is the southernmost of the fifteen openings (all said to be safe though small), that are found along the west side of the atoll; this entrance lies about 3 miles W.N.W. from Delufurhi, the south island. From this island the barrier-reef trends in a north-east direction for 12 miles; thence N.N.E. for 4 miles to the Mulaku opening. The south-east part of the boundary-reef contains more than half the islands of the group, clustered at its extremes; several coral heads, on some of which bushes grow, are here and there seen above the surf, which, even at the north-east monsoon, breaks very high from a long south-east swell.

Mulaku island and entrance.—Approaching this part of Mulaku atoll from southward, the several small islands on the northern portion of the above-mentioned barrier-reef will point out the locality. Mulaku, a large island, at one mile within the opening formed by the extremes of the south-east and east barrier-reefs, may be known by a large banyan tree near its north and centre part; and, when approached from south-eastward, this is seen just midway between Muli and Vevarhu islands, which stand at the sides of the opening. Mulaku town, on the north-east side of the island, contains 200 inhabitants, and affords good water, plenty of wood, and a few other supplies such as the Maldives produce; the most convenient place for watering is between the town and Vevarhu island.

Mulaku entrance is two-thirds of a mile wide between the reefs that project from Vevarhu and Muli, those islands being not quite 2 miles apart. Soundings of 7 to 18 fathoms are found in it, the deepest water being to the south, and the passage into the atoll on the south of Mulaku is also deeper and wider than that along its north-east side, having 18 fathoms water deepening to 24 and 28 fathoms as that island is passed; in these depths a vessel may anchor on a sandy bottom; whereas the northern passage is contracted to a width of only 2 or 3 cables by shoal water projecting from both the east side of Mulaku and the south side of Vevarhu; however, with a fair wind, the centre of this passage is safe, having 8 fathoms water on a sandy bottom.

Muli and Vevarhu islands have each a population of 200, but good water cannot be obtained. The Atoluveri, or chief of the atoll, resided (1834–6) at the former.

North openings.—From Vevarhu the boundary reef trends nearly straight about N.N.E. for 10 miles to the north-east angle of the atoll, on which stand two inhabited islands named Raimandu, thence west for more

See chart, No. 69*b*.

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than 4 miles where there are two passages by the east sides of Maduveri and Diggaru, small islands, both of which are inhabited and have high cocoa-nut trees; these passages are about a quarter of a cable wide, with not less than 7 fathoms water. Between these islands and the north-west point of the atoll are three other openings in the barrier-reef, but they are almost too narrow for vessels to enter, and have no islands to point them out.

West openings.—From the north-west point of the atoll, which is an elbow of the barrier-reef with only a few dry rocks to distinguish it, the west side of the boundary-reef trends nearly straight in a south direction for 24 miles, with fifteen safe openings, though some are very small; indeed, almost at every mile an entrance is found, available for drifting into the atoll, and none of these passages have less water than 10 or 15 fathoms. There is only one island, Tuvaru, along the west side of the atoll, but it has neither inhabitants nor fresh water. Close south of this island there is a good entrance with over 30 fathoms water, but there are coral reefs inside.

Tides.—It is high water, full and change, at Mulaku atoll at 3 h. 0 m.: springs rise about 4 feet.

WATTARU CHANNEL and REEF. — This channel, which separates Mulaku and Felidu atolls, is 8 miles wide, having in its centre a circular lagoon-reef, with a diameter of 4 to 5 miles, dividing it into two passages which are 2 and 2½ miles in width, the southern being the larger; both are very deep, no soundings being obtainable with the ordinary deep-sea lead. These channels are rendered dangerous by the strength of tides and currents, and by the absence of landmarks on the north sides of Mulaku atoll and Wattaru reef. The south end of the latter is, however, tolerably well marked by two low bushy islets, between which is the only opening, with but water enough for boats, into the lagoon; inside there are soundings from 12 to 20 fathoms on a white sandy bottom. On these two uninhabited bushy islets are (1866) some young cocoa-nut trees, and some wells in which the fresh water rises and falls with the tide, being drinkable only at low tides. Rakidu, the southern island of Felidu atoll, marks well the north side of the northern channel. A vessel, drifted into Wattaru channel, may pass clear of the atolls either to north or south of Nilandu, or between the two portions of that atoll, according as the winds suit best.

FELIDU ATOLL has a more irregular outline than any yet described, there are no openings along the south and east sides, but at the south point of the atoll there are two; along the south-west side nine; on

See chart, No. 69*b*.

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the north-west side three; and between the north and east extremes, in the deep bight, sixteen safe openings.

There are only ten islands on this atoll, five being inhabited, with a population of 320. The chief of the atoll (1834-6) resides at Tinadu, near the centre of the deep bight on the north-east side. None of the islands afford wholesome drinking water, what they have being brackish, and the natives catch all the rain water they can by every available appliance; the cocoa-nut trees are very useful for this purpose, leaves being tied round the base of their trunks to act as pipes in conducting the water into jars. Of supplies, firewood is plentiful; a few fowls, some limes and fruit, and a few turtle may be procured.

South and West openings.—The island Rakidu stands between the two south openings, both of which are safe passages with 20 to 30 fathoms water. From these openings the general direction of the boundary-reef is north-west for 15 miles to the west extreme, and in this distance there are nine openings, but the absence of landmarks deters vessels from approaching this side. From the west point of the atoll, where there is a narrow opening, the boundary-reef trends in a north-east direction for 13 miles to Fulidu, an inhabited island at the north extreme of the group; along this north-west face there are three openings, which are not easily seen.

North-east openings consist of sixteen safe passages, though narrow. The first of these lies 1½ miles eastward of Fulidu; the second has no landmark to point it out, and has a sunken rock in mid-channel; the third lies one mile east of Dhiggheri, which bears E.S.E. 5 miles from Fulidu; the next two are 3 miles farther south, on either side of Alimata island. Three islands lie at the bottom of this north-east bight; Tinadu, the northernmost, is the residence of the Moluveri; but the openings, between these islands and some reefs which intervene, are so very narrow, such a heavy swell sets directly upon them in the north-east monsoon, and the tides and currents are so strong, that it would be hazardous for a vessel to attempt these passages, more especially with very light winds. Between these islands and Foteyo, at the east extreme of the atoll, there are other openings, narrow, and without landmarks; this portion of the barrier, as well as the whole south face of the atoll, may therefore be considered one continuous reef.

ARIYADDU and FULIDU CHANNELS.—Ariyaddu channel, between Nilandu and Ari atolls, is 9½ miles wide, free from danger, and has no bottom at 130 fathoms. Fulidu channel, between Felidu and South Mále atolls, is 7 miles wide. Vessels can conveniently pass through these channels, should they unavoidably drift near them.

See chart, No. 69*b*.

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Tides.—It is high water, full and change, in these channels at 2 h. 30 m. The tides set strongly through during springs; periodically retarded or accelerated by the current. Flood sets eastward, ebb westward.

ARI ATOLL, situated north of Nilandu and westward of Felidu and Mále atolls, is 48 miles long north and south, and 17 miles across. It contains about fifty islands, the greater number of which are situated along its eastern boundary, and are generally small. This atoll, in common with those to the north of it, has no continuous barrier-reef round it, except for a short distance at its south extreme. On the west and east sides, and north end, there are numerous good passages leading into the atoll; on the west there are fifteen; at the north extreme of the group, one very wide passage; along the east side there are several safe but small passages; whilst at the south end only one break occurs in the barrier-reef.

In the interior, are numerous large coral reefs, some having depths of 2 and 3 fathoms on them at low water; others dry at low tide, with deep lagoons inside; all may be avoided on a clear day by a good look-out. The general soundings inside the atoll are 25 to 35 fathoms. The influence of the spring tides is felt amongst the interior coral reefs.

South Entrance.—The island Ariyaddu stands in the middle of this passage, which leads from Ariyaddu channel, and is 9½ miles northward of the north-west point of Nilandi atoll. Depths of 26 and 28 fathoms are found on both sides of the island; these passages, though narrow, are safe, leading on a north course into the atoll. Ariyaddu and the island Mamigili, to the west of it, are inhabited, and afford good fresh water.

The West side of the atoll is tolerably straight in a general northerly direction, and is formed principally of large lagoon reefs; the passages between are mostly wide. The southernmost of these passages, about 9 miles north-west of Ariyaddu, is narrow, as are also the next two; but the fourth and fifth are more than 2 miles wide; the inhabited island, Mandu, standing between them on a reef nearly 4 miles long. All the rest of the passages are deep and safe, those on either side of Malos and Feridu being better defined than others by the high trees. The four islands Mandu, Himendu, Malos, and Feridu are inhabited, and afford wood, water, and a few other supplies. The northernmost openings of the west side are situated at 1½ miles above and below Mativari island, which is inhabited and also affords good water and a few supplies.

East side.—At the north end of Ari atoll there is a lagoon-reef extending 6 miles to N.N.E. of Mativari, and having a broad deep entrance on its east side, with soundings of 25 to 29 fathoms; this is a convenient

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See chart, No. 66*b*.

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anchorage, as all dangers are visible. At 2½ miles east of this reef there is a smaller reef, with a good passage between it and the island Ukulahu, at 1½ miles further east, which is inhabited and affords a few supplies, including firewood and water. A small islet lies one mile north of Ukulahu, and another at the same distance east of it; thence a chain of small reefs extends for 6 miles to the northernmost of the numerous islands which form the east side of the atoll. On this side there are numerous passages leading into the atoll at about one mile apart; some are small, but all safe if a good look-out be kept. The south-east opening is the widest, and being situated northward of the large island Digura is easily recognised. This island is at the north-east end of the barrier-reef, which forms the south extreme of Ari atoll.

ROSS (RASDU) ATOLL is a lagoon-reef situated 4 miles north-east of Ari atoll, and connected to it by a plateau with soundings of 100 to 140 fathoms. Ross atoll is circular, its diameter being 4½ miles; the north and west sides are one continuous barrier-reef; the east side is also one reef, but there are openings at the north-east and south extremes of the atoll. The south opening, which is only adapted for small vessels, lies between two islands, Kuramati and Ross. The north-east entrance has 8 fathoms, and is situated about one mile northward of Weligandu island. In the interior of the atoll there are soundings from 15 to 20 fathoms, but detached coral patches abound.

TODDU ISLAND, situated 5½ miles northward of Ross atoll, is a solitary island at the west entrance of Kardiva channel; it is steep and safe to approach, the reef which surrounds it being nowhere a cable distant from the trees, which cover the island and render it visible 20 miles from a vessel's masthead. Toddu contains between 200 and 300 inhabitants, and has good water and some supplies; the islanders are principally employed in fishing. The islands Toddu and Kardiva are good landmarks for Kardiva channel, which is a useful passage through the Maldive archipelago.

SOUTH MÁLE ATOLL is situated 23 miles eastward of Ari atoll, the intermediate sea being free from dangers, and much sheltered from the ocean swell. It is separated on the south from Felidu atoll by Fulidu channel, and from Mále atoll on its north by Wadu channel, 2½ miles wide. The atoll is 19 miles long, north and south, and 11 miles across the broadest part, which is towards the north end. It contains twenty-two islands, three only inhabited, numbering altogether 200 people (1834–6). None of the islands afford good water or other supplies, they are nearly all situated along the eastern boundary, only three or four being

See chart, No. 66*b*.

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on the west side, but there are safe passages on one or both sides of all except the four or five smaller islands at the south-east extreme of the group, which stand on a barrier-reef 8 miles in length. The general depths in the interior are 25 to 32 fathoms, sandy bottom, but it is encumbered with coral reefs, which are, however, easily avoided by a good look-out from the masthead.

South, West, and North sides.—At the south end of the atoll there is a good opening, half a mile wide, with soundings from 20 to 23 fathoms, between the west extreme of the south-east barrier-reef and an islet composed of coral rocks. From this opening, the west side of the atoll trends in a northerly direction, nearly straight for 15 miles, having several safe openings, the widest and best being in latitude 4° 1′ N. Thence the boundary curves round to the north-east, affording two or three small passages through. At the north end of the atoll, on either side of Wadu island, are good openings leading in from Wadu channel.

East side.—Eastward of Wadu openings, a barrier-reef extends nearly 5 miles, having near its east extreme the small island Hurasfinolu, close to the south of which lies the northernmost of the passages leading through the east side of the atoll; this passage is nearly one mile wide, and has an island named Hembudu about 1½ miles within the entrance. From this opening the east side of the atoll trends in a S.S.W. direction for 17 miles to its south-east extreme, having in this length of boundary four or five openings.

Wadu channel, separating North and South Mále atolls, is at its narrowest part 2¼ miles wide, but its depth is great, no soundings being obtainable at 200 fathoms. The tides in it are very strong, flood sets east, ebb west. During the monsoons, that tide, which is accelerated by the prevailing current, runs with a velocity of 4 miles an hour, causing a great rippling and whirlpools, which in light winds it is difficult to steer through.

MÁLE or NORTH MÁLE ATOLL, the principal atoll of the Maldive group, is of an irregular form; the west side is convex, the north-east and south-east concave. It is 32 miles long north and south, 23 miles across the broadest port, and contains about fifty islands, twelve of which are inhabited. The general depths in the interior are from 25 to 35 fathoms, sandy bottom, but in passing through, a good look-out is required, to avoid the numerous coral patches.

Mále or Sultan's island, the capital of the Maldive group, at the south of this atoll, is about one mile long and three-quarters of a mile in breadth. Its south side is inaccessible to boats, being one unbroken

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See chart, No. 66*b*.

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reef just awash ; but the rest of its circumference has a lagoon or harbour, formed by an artificial bank of coral about four feet above water, and six to eight feet broad, roughly built up occasionally; this gives good shelter to the boats of the natives, there being from 3 to 6 feet water within it at the north side of the island, where its entrance is.

Near this entrance stands the principal fort of the island, a solid mass (1834–6), about 20 feet high, faced with stone; a few pieces of unserviceable ordnance are mounted at intervals along the fort wall, which extends round the east and west sides of the island, but not on the south, and it will not be seen by a vessel approaching the island from seaward. The Sultan's palace is a large upper-roomed house with a peaked roof, covered with thick sheet copper; it is in a walled enclosure, which is surrounded by a shallow moat, comprising an area of about a quarter of a square mile. There are several mosques in the town, and a tower 40 feet high, from which the faithful are called to prayer at certain hours.

People.—Climate.—Mále contains between 2,000 and 3,000 inhabitants; many are traders, but the most common employments are fishing, gathering cocoa-nuts, drawing toddy, weaving cloth, and collecting the small cowries which pass as money. None of the islanders in other atolls are allowed to trade with foreign vessels, except at Mále, where all trade must be carried on. The Sultan attires himself like an Indian Mussulman, but no other person dares to wear more than a cloth around the loins, and a plain red handkerchief on the head; nor can any but the Sultan have an umbrella carried over him, for it is one of the insignia of sovereignty.

The Sultan and head men are much pleased if a vessel on arrival salutes with a few guns, which compliment they return, and then the Miru Baharu, or port doctor and master-attendant, boards to inquire after the health of the ship's company, that no contagious disease, particularly small-pox, may be brought to that place. The climate at Mále is, as regards the feelings, neither oppressive nor disagreeable, yet it is very unhealthy, particularly to strangers, either European or Asiatic, and the latter seem to feel its effects first. Nobody ought to sleep on shore, and if this rule be acted upon, a few days' or weeks' residence will not be attended with ill effects.

Good water cannot be got at Mále, but supplies of fresh beef, fowls, and fruit may be obtained.

Anchorage.—There are no soundings to the south of Mále, but round the inner side of the island the depths are from 25 to 28 fathoms, sandy bottom, in which depth a vessel may anchor as convenient. A good berth is with the flagstaff bearing S.E. about half a mile distant. During the south-west monsoon, from June to December, vessels moor on the east

See chart, No. 66*b*.

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side of a lagoon-reef which bears N.N.W. 1½ miles from Mále; on the edge of this reef are several anchors, dry at low water, to which vessels make fast, with a stern anchor to the eastward.

Tides.—It is high water, full and change, at Mále at 0 h. 30 m.; springs rise 3 feet, sometimes 4 feet. The flood-stream sets past the south side of the island to the eastward, the ebb to the westward; when accelerated by the current they are very strong.

South part of Atoll.—About midway in the channel between Mále island and Wilingili island is a shoal with about 4¼ fathoms over it, and deep water around. It is probably composed of coral, measures from half to one cable each way is marked by tide-rips, and is visible from the mast-head. The reef off Mále island is very distinct. The shoal may be avoided by passing the breakwater of that island rather closely, and following the edge of the reef round at a moderate distance.*

There is also a good passage to Mále anchorage on the east side of Mále island available with southerly winds; but, with the northerly or north-east monsoon, vessels are recommended to adopt the next large opening, which is 6 or 7 miles N.N.E. of Mále, and then pass down between the islands and reefs. This opening is nearly 1½ miles wide, with soundings from 25 to 28 fathoms, sandy bottom; its north side is well defined by a remarkable clump of cocoa-nut trees standing at the south extreme of a long reef (care, however, is necessary not to mistake this for a similar clump 3 miles north-eastward, *see* next page). On the southern side of this entrance are two small cocoa-nut islands, and a sand-bank with bushes; a vessel may pass between these, but the best passage is round their north sides, when, after rounding the sand-bank, a S.S.W. and South course may be steered towards Mále flagstaff.

West side of Atoll.—Vessels approaching Mále from the westward in the westerly monsoon, should enter Kardiva channel between Horsburgh atoll and Toddu island, passing the latter tolerably close on the north side, thence steer S.E. by E. for Wadu channel, Toddu and Mále islands being visible 20 miles from the mast-head, the one will not be lost sight of before the other is seen. Giravaru island, lying 6 miles W. by N. from Mále, is half a mile within the line of boundary, and has a passage on the south of it into the atoll in a north-east direction; the reef on which it stands extends nearly 2 miles to the westward and forms the south-west point of the atoll. Northward of Giravaru there are nine openings between the lagoon-reefs along the west side of this group; the largest is abreast the island Hembadu, which is nearly 2 miles within the boundary, in latitude 4° 28′ N. On the north-west side there are three small but safe

* Navigating Lieutenant George S. Keigwin, H.M.S. *Arab*, 1877.
See chart, No. 66*b*.

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openings; one on either side of a thick bushey islet named Akirifurhi, situated 9 miles northward of Hembadu; the third opening is one mile further to the north-east.

North part of atoll and Gafaru reef.—The north part of the atoll is a lagoon-reef 2 miles long, with passages on either side into the internal waters; both have 23 and 24 fathoms water; the western passage lies between two sand-banks, the other is eastward of a coral island which lies 1½ miles northward of Kagi, the most northern island of the atoll, with a clump of trees on it. Northward of this lies the island and lagoon-reef of Gafaru, separated from Mále atoll by a channel, 1½ miles wide, in which no soundings have been obtained. Gafaru island lies 2 miles north of Mále atoll, and stands on the east extreme of the lagoon-reef; the only two openings into which are in the centre of the north-east and north-west faces, but they are very small and have no distinguishing marks.

East side of atoll.—From the north extreme the boundary of the east side trends in a south-east direction for 20 miles, thence south-west for 20 miles to the island Mále. Several large lagoon-reefs, with passages between them, are found along the north-east side of the atoll; there is an opening on either side of Helengeli, a long low woody island with a single cocoa-nut tree (1835), at the distance of 5 miles south-east of Kagi; the rest of the openings have no marks, but a vessel may pass through by keeping a good look-out.

The easternmost islands of the atoll, Mirufen furhi and Diffurhi, are situated 14 miles south-east of Helengeli. As a vessel approaches them from the eastward within 16 miles, they sometimes look like one island; at the same time, a high clump of cocoa-nut trees will be seen beyond them, this is on the little island Asdu, lying some 2 or 3 miles within the boundary. There are two good entrances with Asdu bearing W.S.W. and S.W.; on which courses a vessel can enter the atoll with a northerly wind and proceed to Mále by a good mast-head look-out. Diffurhi has 150 inhabitants (1834–6) and good water; pilots can be obtained here for Mále, but it is doubtful if they will come out, the islanders being timid and reserved.

From the east point of the atoll, the long lagoon-reef on which Diffurhi stands, extends in a south-west direction for 6 miles, having on its south end three small cocoa islets; there is a passage between them and Tulusdu, but it is not recommended. There is another passage at 5 miles farther to the south-west, round the south sides of three smaller islets, on one of which is a remarkable clump of trees. But the best and largest opening lies 3 miles still farther to south-west, or 15 miles from the east extreme of

See charts, Nos. 66*a* and 66*b*.

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the group; this passage should be adopted by vessels bound to Mále in the north-east monsoon.

KARDIVA CHANNEL.—This channel, taking its name from the island that stands near the middle of its eastern entrance, is bounded on the south-east by Mále and Ari atolls, and on the north-west by Fadiffolu, Malosmadulu, and Horsburgh atolls. Its narrowest central part has a width of 24 miles, and its extreme length is about 70 miles in a north-east and south-west direction. Oluvelifurhi island, on the south end of Fadiffolu atoll, has on it a high clump of trees which clearly marks the north side of the eastern entrance into Kardiva channel; but its south side is not so well defined by Gafaru reef, which has no landmarks along its north and west sides. The western entrance of Kardiva channel is not easily recognised, as the tree-islands of Ari and Horsburgh atolls stand some 4 or 5 miles within the prominent points of their boundary reefs; but Toddu island is a good mark for the west, and Kardiva for the east, entrance.

Kardiva channel is useful for vessels bound to and from India. None ought to attempt to work through against the strength of either south-west or north-east monsoons; with wind and current against them, it would be next to impracticable, but it may be advantageously adopted when the monsoon is fair, or at the change of monsoon, when the winds are light and variable. This channel may be particularly useful in November, when an outward-bound vessel has crossed the equator westward of the Maldives, and finds the wind hanging too much from the eastward to allow of the eight-degrees, or nine-degrees, channel being used without much loss of time; and may then be adopted to make Ceylon, or the coast of India by cape Comorin. At the change of monsoon calms are very frequent, yet little or no danger is to be apprehended in passing through this channel.

Kardiva island, thickly covered with high cocoa-nut trees, contains about 200 inhabitants, and affords good fresh water and a few other supplies. Its south-east side is convex and steep-to, having no soundings in 240 fathoms water close to the beach. On its north-west side there is a circular reef, having a lagoon inside, where the natives snugly anchor their boats off the village on the north side of the island. The entrance into the lagoon is near the north-east point of the island, marked by a few sticks placed as a beacon; landing can only be effected on Kardiva by passing through the boat-passage in the fringing reef. There is generally a heavy surf round this island and reef, except at the boat opening.

Tides.—The flood stream in Kardiva channel sets E.N.E. and the ebb W.S.W.; high water, full and change, at noon. During the north-east monsoon, little or no flood stream is felt, but the strength of the ebb is

See charts, Nos. 66*a* and 66*b*.

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considerably increased by the strong current running with the wind. During the south-west monsoon the flood is strong, with little or no sensible ebb stream.

HORSBURGH ATOLL, in lat. 4° 53′ N., long. 72° 53′ E., marks the north side of the west entrance of Kardiva channel, and is separated from Malosmadulu atoll by a deep water channel about 6 miles wide. This atoll is of an oval shape, 10 miles long east and west, and 4½ miles across the broadest part. It has three large inhabited islands on the north and east parts, with an aggregate population of 200; they afford wood, water, and some other supplies. Goidu is the eastern and largest island. The only entrance into the lagoon, the Dorukandu, is on the south side of the atoll; Fehendu (seen from aloft), the central of the three large islands on the north-east side of the atoll bearing N.E. will lead to this entrance, until the several islets which bound both sides of the entrance are sighted; then the passage between them, which is apparently one mile wide will be seen from aloft, but deep water is confined to the west side, thus narrowing the ship-passage to one or 2 cables only. There is good anchorage in the interior, in 17 to 20 fathoms, sandy bottom, mixed with mud and clay, and free from rocks in the centre though they are found near the barrier-reef.

MALOSMADULU ATOLL.—This western atoll, 53 miles in length north and south, is divided into two parts by the narrow, deep, Moresby channel; thus two groups are formed, which have been called North and South Malosmadulu. The south end of the south group bordering on Kardiva channel is available for vessels to anchor that require a few supplies; wood and water can be obtained at Hitadu island, 7 miles north of Horsburgh atoll. But it would be impracticable to navigate through the centre part of the north group, it is so encumbered with small coral patches and rocks, called by the natives the jungle. However, Moresby channel may be adopted by any vessel that through error in reckoning gets entangled in these groups.

South Malosmadulu is of irregular outline; its south-east side is tolerably straight, faces Kardiva channel and trends in a north-easterly direction 21 miles from Hitadu to the east extreme of the atoll. It has about 250 inhabitants. At the south extreme there is a good entrance into the atoll, by which a vessel from the westward may obtain access to anchorage on the north side of Hitadu island. There are passages on both sides of Hitadu and its adjoining islands, as well as between all the islands and reefs along the south-east and north-east boundaries. The Atoluveri, or chief man of the south group, resides at Duravandu island, situated

See chart, No. 66*a*.

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15 miles north-east of Hitadu. It contains about 100 inhabitants and has good water.

The west side of this group is composed of large separate lagoon-reefs with scarcely any islands to distinguish them, but there are passages into the atoll between these reefs. The west entrance of Moresby channel is less than 3 miles wide; it is difficult to make out, having no tree-islands, but only barrier-reefs. Another deep but very narrow channel lies in an east and west direction through the atoll southward of Moresby channel, having a common entrance with it on the west.

North Malosmadulu is 35 miles in length north and south, and only 15 miles across its broadest part; but its character is similar to the southern atoll, having its west side composed of a series of round or oval lagoon-reefs irregularly placed, some prominent, others retiring (a peculiar feature of all these northern atolls), whilst the east side is a gentle curve with twenty islands, between which there are good passages leading into the atoll. None of these islands have good water, except Fainu, the second northward from Moresby channel, where the collector of revenue, the chief of atoll, resides. The lagoon-reefs along the west boundary have little to point them out, and had better be avoided, especially as no vessel could navigate through the intricacy of the atoll's centre; but its northern end is narrow and clear of reefs, and may be navigated through with ease; the general depths are from 23 to 27 fathoms water.

The north part of this group has a broad passage between two reefs, with plenty of ground on which vessels might anchor; then a channel, 3 miles wide, in which there is no bottom at 200 fathoms, between those reefs and Powell islands, which consist of two inhabited islands, the northern named Ettingili, and the southern Alifurhi, standing on a detached reef with no soundings at 100 fathoms, close to.

FADIFFOLU ATOLL, situated 10 miles eastward of Malosmadulu, is 19 miles long, north-west and south-east, with an average breadth of 12 miles. Aligau island, 16 miles N. by E. from Kardiva, has high trees, and well marks the west extreme of the long barrier-reef that forms without any opening the entire south-east face of the atoll. There is a wide opening on the north-west side of Aligau, and along the south-west side are several other good passages between islands.

The north-west islands can furnish good water and some other supplies. The Atoluveri resides at Naifaru, one of the most thickly inhabited islands, situated at one-third of the distance from the west to the north point of the atoll. Passages into the interior occur between all the north-west islands; that between the two northernmost islands is more than half a mile wide,

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See chart, No. 66*a*.

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with 17 and 20 fathoms water, but some reefs will be found inside. Along the north-east side there are only two or three openings, and these are in the northern part; thence unbroken barrier-reef extends to the east extreme and round to Aligau, the south point of the group. In the north-east monsoon the sea breaks with considerable violence along this extensive barrier-reef, which is 18 miles in length and has several islands; at low water large masses of coral rock and some sand-banks are observed along its sea-face.

Within this atoll many coral patches, dry at low tide, and several sunken reefs are found, with 6 to 12 feet water on them; the general depths on a sandy bottom are from 25 to 30 fathoms. There are upwards of twenty islands in this atoll, but only four inhabited, and they contain 550 people. The tides and currents run strong through the openings into the atoll.

MILADUMMADULU ATOLL, separated from Malosmadulu by a channel, 7 miles wide, and from Fadiffolu by a channel, 9 miles wide, contains one hundred and one islands, which extend over a space 56 miles in length, in a north-westerly and south-easterly direction, by not quite 20 miles in breadth; twenty-nine of these are inhabited, and contain a population of 1,700 or 1,800. The islands lie principally on the east and south-east part of the atoll. The officers who surveyed these islands report that cotton is grown in small quantities on some of them, and it is reasonable to suppose that others of the Maldives might produce the same with a little trouble.

Vessels can easily pass through this group in the daytime as the interior has few reefs, especially in the northern portion; the general depths are from 20 to 25 fathoms, sandy bottom, with clay at times. The tides are felt in the atoll, running about 1½ to 2 miles an hour at springs; the flood E.N.E. and ebb W.S.W.; the currents influence the tides greatly. The islands and lagoon-reefs which form the boundary of this atoll are more separated than in the groups previously described, thus leaving wider passages into the interior. There are not many islands along the west frontier but more lagoon-reefs, not in one connected barrier but in detached portions; on some are small islands, and between the whole are safe passages.

Manadu and Kendikolu, the principal islands, are both near the south-east boundary, the former about 8 miles from the atoll's south end, the latter about 10 miles farther north. Good anchorage may be obtained at Manadu, either on its north or south sides, according to the season; it is a beautiful island, covered with groves of bread-fruit trees and other luxuriant foliage; it contains 100 inhabitants, whose village is on the north side of the island, but good landing-places are found on both

See chart, No. 66*a*.

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north and south, and a good pathway through the island. The Atoluveri resides at Manadu. Good water and some other supplies may be obtained; the natives keep their boats inside the reef on the north-east side of the island. There is good anchorage also to the west of Kendikolu, near its south point, where good water may be obtained from the village; the passage into the atoll round the south side of this island is wide and safe.

MALCOLM (Makunudu) ATOLL, a lagoon-reef, 15 miles long, north and south, and only about 3 miles broad, lies 9 miles west of Miladummadulu. It was unknown to Europeans previous to the survey of the Maldives in 1834–36; but, according to native information, many ships have been totally wrecked on its barren reef, and all lives lost, scarcely a vestige of a wreck being left after a few hours from the violence of the surf and the perpendicular sides of the reef. The lagoon is deep but full of coral patches, and has two passages into it along the east barrier, but they can only be used by boats.

The north-east point of this little atoll is well marked by Makunudu island, which contains 100 inhabitants and has good water. The north-west projection has also a small island, but the remainder of the west side and the south have nothing to point them out but the surf. The south end of this reef bears N.W. by W., 24 miles from Powell islands. About midway along the eastern side is Defarudorhi islet with high bushes.

Tides.—It is high water, full and change, at Malcolm atoll, at 10 h. 30 m.; springs rise 3 feet. There are two tides only in 24 hours.

TILADUMMATI ATOLL is a continuation of, and stands on the same plateau of soundings as Miladummadulu, the frontier islands of both are visible one from the other; and it is not known why the natives give the two portions different names. From its junction with Miladummadulu the atoll extends in a N.N.E. direction for 30 miles. There are nearly forty islands in this group, generally of a large size and some distance apart; those at the north and east extremes are largest and inhabited, affording good water and some supplies. Safe passages occur between them all. Kelai, the northern island, forms a very prominent point to the atoll; it is low, like all the rest, but covered with cocoa-nut trees, which are visible at the distance of 15 miles from the mast-head.

The west boundary has not so many islands but more reefs, with safe passages between, but they had better be avoided.

Gallandu channel, between Tiladummati and Ihavandiffulu atolls, is 2½ miles wide at its west and narrowest part. Soundings have been found in the channel of 601 fathoms; but should a vessel be drifted

See chart, No. 6*a*.

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into it, there are passages into the atolls on either side where anchorage may be obtained.

IHAVANDIFFULU ATOLL is the most northern atoll of the Maldive group. It is 13 miles in extent north-west and south-east and 7 miles across. There are twenty-four islands in this atoll, three or four of which are large; they lie on all sides of the boundary, but the principal islands are at the south-west and north-east sides; seven only are inhabited, containing a population of 760. Wood, water, and some other supplies can be obtained at these islands. There are three small islands in the centre of this atoll, abounding with fine green turtle, seldom disturbed by the natives, who do not eat them. The general soundings in the centre are 20 to 30 fathoms, but several small coral patches are scattered about.

Ihavandu, near the atoll's south end, is the principal island, being the residence of the Sultan's wazír; it has 150 inhabitants, good water and some supplies. It is of triangular form, nearly one mile in greatest length; the margin is composed of coral thrown up some 12 feet above the level of the sea. The west side of the island is thickly planted with cocoa-nut and bread-fruit trees; the north and east sides have a thick brushwood; but the interior, which is 3 or 4 feet lower than the sides, has been cleared for the cultivation of a small grain called *bimbi*, which, with a few sweet potatoes, pumpkins, and limes, and the cocoa-nut and bread-fruit are the only vegetable productions. Rice is imported from India, but only the richer inhabitants can afford it. The boníto is caught in great quantities, and is the principal article of food. Fowls are abundant on all the islands, but not easily procured, being wild and difficult to catch. Money will not fetch its full value, as the natives have little use for it; rice, tobacco, and betel-nuts are the best medium of barter.

Openings.—One long barrier-reef forms the west side of the atoll; its south extreme is also a barrier-reef. Between these reefs there is a good opening with 11 fathoms water, opposite which, at the distance of one mile within, stands the island Ihavandu. Along the eastern margin of the atoll are nine islands; the southern marks the east extreme of the south barrier-reef, and may be passed quite close along its north side. Between all the others (except the two large eastern islands Gamautikandu and Muladu, which are connected by a reef), there are ship passages, but that between Gallandu and Muladu has two coral shoals with only a few feet water on them; these shoals form three passages, each about one mile wide.

Anchorage.—Vessels bound to Ihavandu from the eastward had better avoid the above shoals by passing close to Gallandu island on either

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See chart, No. 66*a*.

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side. In approaching Ihavandu from the westward, it will appear as the southernmost tree-island of the atoll, and may be steered for when bearing E.N.E. In the south-west monsoon anchorage may be obtained between the east side of Ihavandu and a small reef dry at low water at half a mile off shore. In the north-east monsoon the best anchorage is off the south-west side of the island, in 15 fathoms water, northward of the barrier-reef which bounds the south point of the atoll.

Tides.—It is high water, full and change, at Ihavandiffulu atoll, at 9 h. 30 m.; springs rise about 5 feet, and the streams run about 1½ miles an hour. At the head of the Maldives, the tides are extremely irregular, and are at all times influenced by the prevailing winds and currents; thus, in the north-east monsoon, the ebb stream seems to run longer than in the opposite season. During strong westerly breezes the flood sets to eastward for the greater part of the day; but when the wind moderates, the ebb takes its turn and sets westward in like manner, the water falling half a foot lower than it ordinarily does at springs.

In Gallandu channel, the flood stream runs E.N.E., and the ebb W.S.W.

CURRENTS.—The currents, about the northern part of the Maldive chain, set to the westward from December to April inclusive; from May to August to the eastward and north-east; about the middle of September they turn southerly, and continue so until the squally period in December, which ushers in the north-east monsoon.

EIGHT-DEGREES CHANNEL, 69 miles in width, between the head of the Maldives and Minikoi island, is perfectly safe, and adopted by vessels bound to the Malabar coast or Colombo during the south-west monsoon; or if bound to Bombay or more northern ports at the close of that monsoon in November, when the north-westers of the Malabar coast are over and its land winds are pretty well established. It will be prudent to keep nearer to Minikoi than to the Maldives, as the current sets to the southward between the end of September and the close of the year.* In the strength of the south-west monsoon, mid-channel is the best track, or rather inclining towards the Maldives.

The currents in this channel are much the same as at the head of the Maldives, but, in the north-east monsoon, they at times set to the north-west, and northward when southerly winds occur, though very rarely.

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* H.M. Ship *Undaunted*, which passed through Eight-degrees channel on the 29th August 1875, found, on making the north island of Ihavandiffulu atoll, that she had during the preceding twenty-four hours been set 23 miles S. 5° E., *i.e.*, nearly at right angles to her course, though on the previous day the current had set S.E. by E. —*Navigating Lieutenant T. Roberson.*

See chart, No. 2,738.

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MINIKOI ISLAND, though generally spoken of as one of the Laccadive group, is upwards of 100 miles from them, and 69 miles northward of the Maldives. It is very populous, and the natives are hospitable; they are under the jurisdiction of the British authorities in Malabar, and the island is in the district of the Collector, who resides at Calicut. To give a general notion of the relative position of Minikoi to the Malabar coast, it may be stated as being nearly in the latitude of cape Comorin, from which it is distant 270 miles.

The island is 5 miles long, north-east and south-west, and very narrow, with an irregular coral reef projecting from its west face for nearly 3 miles, and joined to the extremes of the island; but on the south-east side there is no reef. The island is well planted with cocoa-nut trees, which are about 80 or 100 feet, and in some cases 110 feet high, and can be seen from a vessel's deck 12 or 14 miles off. On the reef near the west point of the island stands a small islet with trees called Small-pox island. At the north end there is a passage through the reef with general depths of 10 to 12 feet, through which boats and small vessels pass, but it is narrow and intricate, and has several patches of coral with only a few feet water, showing in all directions.

Inside the lagoon there is a deep channel, about 3 cables off the shore, reaching to the south end of the village. A vessel drawing 10, or even 12 feet, might, in fine weather, and taking the precaution, with the assistance of a pilot, to buoy the shoal heads, enter the lagoon at high water; but for a vessel drawing more than 6 feet it is inadvisable to attempt to enter the lagoon, unless a prolonged stay is intended.

Pilots are readily provided by the native governor for moderate payment.

Beacon.—The north-west edge of the reef is marked by a beacon 12 feet high, which lies 2 miles N. by W. ¾ W. from the lighthouse.

Anchorage.—During the north-east monsoon anchorage may be obtained about 3 cables off the barrier-reef, on the west side of the island, to the southward of the boat channel into the lagoon from the westward, this anchorage is however foul and insecure. The best depth in which to anchor is 10 fathoms, as the water shoals quickly from that depth to the reef, and deepens as rapidly outside 15 fathoms.

H.M.S. *Ready* slipped off into deep water almost immediately after anchoring in 15 fathoms; but the anchor afterwards, during the whole of her stay (8 days), held when let go in 10 fathoms. Occasional squalls off the island were experienced during the interval. When swung towards the reef, with 40 fathoms of cable out, there was not less than 5 fathoms under the stern. It was found necessary to keep the steam ready.

See chart, No. 2,738, with plan and sketch of Minikoi island.

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During the south-west monsoon the only available anchorages are on the north and east sides of the island. These anchorages are much more contracted than that on the western side of the island.

LIGHT.—The lighthouse at the south-west end of Minikoi is 122 feet high, is painted white, and exhibits, at an elevation of 150 feet above high water, a *flashing white* light, showing a flash of 3½ *seconds* duration, *every half minute*, visible in clear weather from a distance of 19 miles.

On a S. 39° W. bearing (in line with the length of the island), the light is obscured by cocoa-nut trees within a distance of about 8 miles, which increases to about 12 miles on a S. 63° W. bearing, and again diminishes to 1½ miles on the bearing N. 78° W. The top of the lighthouse, and the lantern, are rarely discernible by day above the trees.

Position.—Lat. 8° 16′ N., long. 73° 1′ E.

NINE-DEGREES CHANNEL, bounded on the south by Minikoi and northward by Suheli and Kalpeni islands, has a width of 108 miles. It is used at the close of the south-west monsoon by sailing vessels bound to Bombay; or in the strength of the south-west monsoon by vessels bound to Cochin or Ceylon, when the route either northward or southward of Minikoi may be adopted at discretion.

LACCADIVE ISLANDS consist of a dozen small islands with a few detached reefs and banks; they stand on the verge of steep coral reefs, close to which no soundings are obtainable, therefore great caution is requisite in approaching any of them in thick weather or in light winds.

Being all low, with cocoa-nut trees only 60 or 80 feet above the sea, these islands are discernible but a short distance, and should be avoided by navigators; but amongst them are safe and wide channels through which a ship may extricate herself if, by any error in reckoning or otherwise, she gets amongst them. The group belongs partly to the British Government, and partly to the bibi of Kannanur, with which place these islanders have their principal trade.

Suheli, the south-westernmost reef of the group, is an irregular, broken reef, enclosing a lagoon, in which are two small uninhabited islands, the northern being in lat. 10° 8′ N., long. 72° 19° E. These islands are covered with scrub, and palms about 90 ft. high; the southernmost is about 3¼ miles from the south extremity of the reef. The reef, which dries at low-water springs, is 9½ miles long north-east and south-west, and 3½ miles across.

There are good entrances on the north-west side of the reef for small vessels of 6 feet draught.

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* *See* charts, Nos. 2,738 and 2,737.

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Kalpeni, the south-easternmost of the Laccadives, bearing East 75 miles from Suheli, is composed of two narrow low islands, standing on the east side of a lagoon-reef, 6 miles long north and south, and 2 miles broad. The southern or larger island (Kalpeni), with a population of 700 or 800, is well planted with cocoa-nut trees, the tops of which are 84 feet above the sea. From the south end of Kalpeni, off which there are soundings of 10 fathoms, the barrier-reef extends round the west and north, and joins the north end of the northern island (Cheria). This reef is steep-to with high breakers; through one part of it is a narrow boat passage into the lagoon; the boats of the natives lie at the south-west part of Kalpeni.

Androth island lies 39 miles north from the north end of Kalpeni, and the channel between them is clear of danger. This island, which is $2\frac{1}{8}$ miles long, east and west, and less than half as broad, is low and well planted with cocoa-nut trees, and contains (1889) about 4,500 inhabitants; it is defended by coral rocks all round, through which there is only one small passage for boats. The south side is very steep-to, but on the north an extensive coral bank projects some 6 or 7 miles, with depths of 7 to 16 fathoms.

Anchorage.—Vessels may anchor in any part along the north shore at a distance of half a mile in 5 to 6 fathoms, or off the east point of the island where the bottom appears to be smoother, in 9 or 10 fathoms, sand and rock. In the north-east monsoon, vessels may anchor in 10 or 12 fathoms, about half a mile from the shore, at the south-west end of the island with its extremes bearing from N.N.E. to E. by S., but there would be little shelter.

There are two or three landing places on the north side of the island, the best being abreast the village about one mile from the west end. Turtle may be obtained here; the water is tolerably good; the natives are poor and inoffensive. Androth is the nearest island to the Malabar coast; mount Dilli bears from it N.E. $\frac{1}{2}$ E., and is distant 113 miles.

ELICALPENI BANK, of circular form, about 4 miles in diameter, bears N.E. by N. 26 miles from Androth; its centre is in latitude 11° 13′ N., and longitude 73° 57′ E. It is composed of sharp coral rocks; the least water found, during the last examination was 6 fathoms, but Captain Byrom in 1835 obtained soundings in latitude 11° 16′ N., varying from $3\frac{3}{4}$ to 9 fathoms; this locality should therefore be avoided, particularly during the high sea of the south-west monsoon. The bank lies S.W. by W. 84 miles from mount Dilli, the nearest part of the Malabar coast.

See chart, No. 2,737.

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KAVARATTI ISLAND lies N.E. by N., 30 miles from the northern Suheli island, and W.N.W. 63 miles from Kalpeni; the channel between them being clear of dangers.

Kavaratti is a low island, nearly 3 miles in length, north-east and south-west, by about three-quarters of a mile in breadth towards the north end, narrowing to about 200 yards, a mile from the south extreme of the island. The northern part is thickly planted with cocoa-nut palms, the tops of which are about 90 feet above high water; the southern part has a few palms and a growth of scrub. On the north-west side of the island, a coral reef, enclosing a shallow lagoon, lies nearly parallel to the beach, and extends 6 cables from the shore. In the boat entrance at the north end of the lagoon there is a depth of 3 feet.

Anchorage.—At the south end of the island a flat ledge extends for about 7 cables, and is 7 cables across, where anchorage can be obtained in 4 to 7 fathoms, sand and coral, during the north-east monsoon. The remainder of the reef is steep-to, the hundred-fathoms line of soundings being distant 2 to 3 cables from the reef. In October the flood tide was observed to set S.E. and the ebb N.W. from a half to one mile an hour.

A village with (1892) about 2,000 inhabitants is situated on the north-west side of the island, where a considerable trade is carried on with Cochin, the exports being mats and coir rope, and the imports food and clothing.

Supplies.—Good water can be obtained from wells, but there are no other supplies.

Piti Sand-bank, about 6 feet above the sea, without any shrubs or verdure, bears N.N.W. ½ W., 13 miles from the north end of Kavaratti, and stands at the south extreme of an extensive coral bank. It appears to have an area of not more than 2 acres, and probably the sea makes a clear breach over the bank in the south-west monsoon. Piti is generally covered with birds, and on its east side there is a black rock.

Bank of Soundings.—From Piti an extensive bank of sand and coral, with a breadth of 10 miles at its widest part, extends in a N.N.E. ½ E. direction for 22 miles to the small island of Ameni, upon which the soundings range from 6 to 20 fathoms. It has not been thoroughly examined.

Ameni island,* at the north-east extreme of the coral bank just described, is about 1½ miles in diameter, and surrounded by rocks for a small distance. A vessel may anchor south-west of it in 8 to 10 fathoms in the north-east monsoon.

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* The islanders reported a shoal bank to lie 10 miles north-west from Ameni, but a fruitless search for it was made by the surveying brig *Taptee*.

See chart, No. 2,737.

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CARDAMUM (Kardamat), the north end of which is in lat. 11° 15′ N., long. 72° 47′ E., stands on the eastern side of a coral atoll, and is 4½ miles long N.N.E. and S.S.W., with an average breadth of 3 cables for two-thirds of its length from the north end, narrowing to a point at the south extreme. The centre of the island is thickly planted with cocoa-nut palms, the tops of which are 85 feet high; the extremes of the island are covered with a low growth of scrub. The coral reef, which dries at low-water springs, and encloses a shallow lagoon, extends nearly parallel with the island at a distance of about three-quarters of a mile, and embraces both ends of the island, but projects 1¼ miles from the south, and only one-third of a mile from the north end. Near the north extreme of the island there is a narrow boat passage, the only break in the reef, but native boats pass over the reef in some parts at high water.

There is a small village in the centre of the island, with a population (1891) of 338.

Supplies.—Water is obtained from wells; there are no other supplies.

Anchorage.—Off the south end of the reef depths of less than 20 fathoms extend for a distance of 4 cables, and in fine weather, anchorage may be obtained in 15 to 20 fathoms water. Small vessels can anchor near the boat passage, at the north extreme of the island in 17 fathoms, at 2 cables from the reef. There is a deep-water channel between Cardamum and Ameni islands.

AUCUTTA ISLAND is 4 miles long N.N.E. and S.S.W., and about half a mile across towards the north end, tapering to a point at the south extreme. The northern part of the island for about 2½ miles is thickly planted with cocoa-nut palms, the tops of which are about 80 feet high, the remainder is covered with shrub. A clump of cocoa-nut palms, which forms a good mark for anchoring, is situated about one mile from the south extreme. The population (1891) amounts to 1,350.

The small island of Kalputi lies close to the south extreme of Aucutta, and is in lat. 10° 48′ N., long. 72° 10′ E. Both islands are surrounded by a coral reef, which on the western side projects out about 2 miles and encloses a shallow lagoon. The entrance to this lagoon bears N. 38° W. from the clump of cocoa-nut palms on Aucutta, and is always available for boats.

Anchorage may be obtained in 10 to 12 fathoms, coral, off the entrance, but it is not recommended. Between Aucutta and the reef, at 4 miles north-east of it, there is an extensive plateau, with depths of 5 to 9 fathoms, apparently free from dangers. Good anchorage can be obtained on any part of this plateau, using the lead as a guide.

See chart, No. 2,737.

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Supplies.—Good water can be obtained from wells, but there are no other supplies.

Bingaro and Tingaro islands.—Bingaro is situated 6 miles N.E. by E. from the north extreme of Aucutta island, and lies in the centre of an encircling coral reef; it is three-quarters of a mile long north and south, and nearly half a mile across its broadest part. The encircling reef projects 2½ miles N.W. ½ N. and 2½ miles E.N.E. from Bingaro, but on the south side it projects only three-quarters of a mile.

Tingaro lies one mile within the north-east point of the reef with which it is connected by a chain of low islets and sand cays. Both these islands are covered with trees about 80 feet high; they are uninhabited, and no good water can be obtained. On the western side there is an entrance to the lagoon about three-quarters of a mile wide, westward of which good anchorage may be obtained in 5½ fathoms, coral, with the north point of Bingaro bearing E. ¾ N.; on the north and east sides the reef is steep-to.

Peremul Par, an irregular and broken reef enclosing a lagoon, is somewhat crescent shaped, the concave side facing the N.N.W., it is 7½ miles long N.E. ½ N. and S.W. ½ S., and 5 miles across its broadest part. Near the north-east extreme there is a sand cay 4 feet above the water, in lat. 11° 13′ N., long. 72° 6′ E.

The reef, which is very narrow, shows at low water, but at high water, with a smooth sea, the edge is difficult to distinguish, as in many parts it does not break. Within the reef and extending towards the centre for about three-quarters of a mile, round the south-west and north sides, there is a flat with less than 6 feet water; the remainder of the lagoon is encumbered with coral heads and ridges which dry, the depths between are from 6 feet to 6 fathoms. There are several good boat entrances on the east side, and two on the west.

The hundred-fathoms line of soundings extends round the reef at a distance of 2 to 4 cables, except off the north-west point, where it is distant 1¼ miles.

Anchorage.—During northerly winds anchorage can be obtained on the west side of the reef, abreast the boat entrances, in 10 fathoms water, at 3 cables from the reef. Also off the north-east side, in 10 to 12 fathoms, with the sand cay bearing S.S.W. ¾ W., distant 4½ cables.

BITRA lies 17½ miles N. by E. from Peremul sand cay; the reef, which encloses a lagoon 6 miles long N.N.E. and S.S.W. and 2¾ miles across, dries one to 3 feet at low water, springs; it is narrow on the north and west sides, but increases in breadth on the south and east sides.

See chart, No. 2,737.

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Tree island, in lat. 11° 36′ N., long. 72° 11′ E., at the north extremity of the reef, is nearly half a mile long north-west and south-east and about one cable across; the centre is covered with cocoanut palms 55 feet high; it is occasionally visited by fishing boats.

Two sand cays just showing at high water are situated on the eastern part of the reef, southward of Tree island; between these cays the sand dries in patches at low water. Close south of Tree island there is an opening in the reef half a mile wide, with depths of 9 feet, where boats can enter the lagoon. The average depth within the lagoon is from 3 to 4 fathoms; there are however many coral heads, awash or dry at low water in the interior, especially towards the south end. The hundred-fathoms line of soundings on the west side of the reef lies from 3 to 5 cables from the edge, and on the eastern side is distant about 3 cables.

Anchorage can be obtained in 10½ fathoms, water, abreast the opening south of Tree island, with the right extreme of the island bearing N.N.W. ¼ W., distant about 6 cables. When steering for this position care is necessary, as the tides at springs set strongly in and out of the lagoon. Turtle abound at Bitra.

KILTAN ISLAND, bearing East from the south extreme of Bitra reef, and North-east 17 miles from the north end of Cardamum, is nearly 2 miles long north and south; it is well covered with trees and contains (1887) about 500 inhabitants. The island is steep-to along its east face, but on its western side has a fringing reef, which extends about half a mile from the island, having beyond it a narrow bank of soundings; off the south end of the island the bank of soundings extends half a mile.

Anchorage.—The best anchorage for communicating with the shore is off the north-west point of Kiltan, in 7 or 8 fathoms water, about 4 cables from shore. This position is near the landing place, within the fringing reef, which has but a narrow passage for boats. At 6 cables south of this passage there is a gap in the reef, with smoother water than at the northern opening. Anchorage may also be obtained off the south end of the island in 5 or 6 fathoms water, about 3½ cables from the shore.

CHETLAT island, the north end of which is in lat. 11° 42′ N., and long. 72° 42′ E., bears E. by N. 32 miles from the north end of Bitra. It is about 1½ miles long north and south, and its east face is steep-to, but a coral reef stretches round its west side in a semi-circle of three-quarters of a mile radius, having a narrow bank of soundings outside which extends north and south of the island, affording anchorage in fine weather. The island is well planted with trees, and inhabited; the water is tolerably good, and excellent poultry, though in small quantity, may be procured.

See chart, No. 2,737, with plans of Kittan and Chettat islands.

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Anchorage.—The best anchorage in the north-east monsoon is off the south end, in 6 to 10 fathoms water, with the extremes of the island bearing between N. by E. and N.E., and the west extreme of the barrier-reef about N.N.W.; this position is about 4 cables from the island. It is advisable to employ a native boat in communicating with the shore. Chetlat, as well as Kiltan, belong to the British Government, whose representatives are a few peons from Calicut.

Tide.—It is high water at full and change at Chetlat at 10 h. 30 m.; springs rise 7 feet, neaps rise 4 feet.

BYRAMGORE (Chereapani) REEF is 10 miles long north-west and south-east, but including the bank of soundings off its north end, the extreme length is more than 12 miles, and its breadth is 5 miles. The south-east point of the reef, which dries at low water, is in lat. 11° 49′ N., long. 71° 50′ E., and bears N.W. by W. 24 miles from Bitra island; the channel between is clear and safe. There is a narrow bank of soundings off the east, south, and west sides of this reef, but that on the north is 2 miles broad, with overfalls of 6, 4, and 8 fathoms water; there may, however, be less depths, and it should be avoided, for it is studded with coral rocks, which can be plainly seen from a vessel passing over them.

The coral rocks forming the reef are discernible at low water; but, as this and Cherbaniani reef are steep-to, the approach at night is very dangerous, for the noise of the surf would not be heard unless a ship were to leeward in calm weather. The current frequently sets 12 or 15 miles during the night in uncertain directions, especially in the unsettled weather at the change of monsoons; the direction is usually between south-east and south-west during February, March, and April.

CHERBANIANI (Beleapani) REEF, the northernmost dangerous reef of the Laccadives, is 7 miles in length north and south, and its south end bears N.N.E. from the north end of Byramgore bank, leaving a fair channel of 18 miles between them. There are sand-banks on the north and east sides; by the latter there is a passage into the interior for boats. At the south end are a few coral rocks, which seem always to be above water, but the greater part of the boundary reef is only visible towards low water. The east, north, and north-west sides are as steep as a wall, but off the south and south-west sides a bank of soundings extends nearly one mile, and on this vessels may anchor in the north-east monsoon, in 9 or 10 fathoms water.

Position.—The north extreme of the reef is in latitude 12° 24′ N., longitude 71° 53′ E.

See chart, No. 2,737.

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Tides.—It is high water, full and change, at Cherbaniani and Byramgore reefs, at 10 h. 0 m.; springs rise 7 feet, and neaps 4 feet; the flood sets to the north-east and ebb to the south-west. The ebb stream is the stronger and runs for 8 to 10 hours at springs, during the north-east monsoon, when the drain of current runs with it; at that season the flood stream is scarcely perceptible, although the regular rise of tide is visible on the reef.

BASSAS DE PEDRO (Padua) BANK, is a large bank of soundings of crescent form, concave to the east, ranging over a space about 70 miles in length, by 10 to 15 miles in breadth, lying between latitudes 12° 30′ and 13° 38′ N., and the meridians of 72° 15′ and 72° 45′ E. On the northern part the soundings are from 20 to 28 fathoms, and on the southern part 22 to 34 fathoms, sand, shells, and rotten coral; the water on the bank is not discoloured, so as to indicate soundings, and the edges of it are steep-to.

SESOSTRIS BANK, lies about 15 miles westward of Bassas de Pedro bank, between the parallels of 13° 0′ and 13° 14′ N., and the meridians of 71° 52′ and 72° 5′ E. The general soundings on it are from 16 to 22 fathoms, but near both north and south extremes, casts of 11 and 12 fathoms were found; the sides are steep-to.

CORA DIVH, lies N.N.E. of Sesostris bank, and north-west of Bassas de Pedro bank between latitudes 13° 34′ and 13° 52′ N., the centre being in longitude 72° 10′ E. The soundings on this bank range between 24 and 29 fathoms, the bottom sand, decayed coral, and broken shells; its length is 20 miles in a N.N.E. and S.S.W. direction, and its average breadth 6 miles.

See chart, No. 2,737.

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APPENDIX.

TABULATED MONTHLY and ANNUAL AVERAGE RAINFALL, as deduced from the registers of several years, at the following stations, in Ceylon and on the West Coast of Hindustan.

Month.	Galle.	Colombo.	Karwar.	Vengurla.	Ratnagiri.	Bombay.	Surat.	Broach.	Karachi.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
January -	4·16	3·02	0·18	0·14	0·99	0·12	—	0·02	0·81
February	3·15	2·06	—	—	0·03	0·01	0·08	0·02	0·19
March -	4·72	4·98	0·07	0·06	—	—	—	0·01	0·14
April -	9·64	10·89	0·25	0·07	0·16	0·04	—	0·01	—
May -	11·85	12·96	3 03	2·13	1·41	0·53	0·11	0·05	0·03
June -	8·08	7·65	33·84	33·94	31·45	20·45	9·38	6·93	0·26
July -	5·34	4·85	36·60	36·40	33·47	24·12	13·09	14·81	2·58
August -	5·26	3·92	21·91	21·62	19·32	12·83	10·19	9·10	1·88
September	7·90	5·19	12·91	11·91	12·81	9·65	7·19	6·51	0·80
October -	14·07	14·08	4·57	3·74	8·09	2·02	1·12	1·38	0·10
November	11·78	12·34	1·62	0·88	0·80	0·49	0·10	0·17	0·03
December	6·37	6·29	0·14	0·08	0·05	0·05	0·03	0·04	0·21
Total for the year	92·32	88·23	114·40	110·97	103·58	70·31	41·24	39·05	7·03

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LIST OF SAILING DIRECTIONS, &c., PUBLISHED BY THE HYDROGRAPHIC DEPARTMENT OF THE ADMIRALTY, JANUARY 1901.

Title.	*Price.* s.	d.
GENERAL.		
Ocean passage book, 1st edition, 1895	1	6
BRITISH ISLANDS.		
Channel Pilot, part 1. South-west and South coasts of England, 9th edition, 1899	2	6
——— 2. Coast of France and the Channel islands, 6th edition, 1897	3	6
Supplement, 1900	0	6
North Sea Pilot, part 1. Shetland and Orkneys, 4th edition, 1894	2	6
Supplement, 1898	0	6
——— 2. North and East coasts of Scotland, 5th edition, 1895	4	6
Revised Supplement, 1900	0	6
——— 3. East coast of England, from Berwick to the North Foreland, including the Estuary of the Thames, and rivers Thames and Medway, 6th edition, 1897	3	0
Supplement, 1900	0	6
——— 4. Shores of the North sea, from Calais to the Skaw, 6th edition, 1901. (*In progress.*)		
Sailing directions for the West coast of Scotland, Cape Wrath to Mull of Galloway, including the Hebrides or Western islands, 4th edition, 1894	4	0
Hydrographic Notice, No. 3 of 1897	0	2
Sailing directions for the West coast of England, from Scilly isles to the Mull of Galloway, also the Isle of Man, 5th edition, 1901. (*In progress.*)		
Irish Coast Pilot, 1893	3	6
Supplement, 1898	0	6
NORTH OF EUROPE AND BALTIC SEAS.		
Norway Pilot, part 1. The Naze to Christiania; thence to the Kattegat, 3rd edition, 1897	4	0
——— 2. From the Naze to North cape, thence to Jacob river, 2nd edition, 1894	5	6
Supplement, 1897	0	8
Arctic Pilot, vol. 1, sailing directions for the Barents, Kara, and White seas, comprising also the North coast of Russia from Jacob river to the Yenisei, 1st edition, 1898	6	0
Baltic Pilot, part 1, containing directions for the Kattegat, the Sound, Belts, and channels to the Baltic, 3rd edition, 1895	5	6
Supplement, 1900	1	0
——— part 2, comprising the Baltic sea, the gulf of Finland, and the gulf of Bothnia, 3rd edition, 1896	4	6
Supplement, 1900	2	6

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Title.	Price. s. d.
Atlantic and Mediterranean, &c.	
Arctic Pilot, vol. 2. Containing sailing directions for the Færoe islands, Iceland, Jan Mayen and Spitzbergen and the East coast of Greenland, 1st edition, 1901. (*In progress.*)	
*Færoe Islands Pilot, 1891	0 9
*Information relating to currents, ice, and magnetism, with general remarks on the coast of Iceland, 1891	1 0
*Icelandic Pilot, part 1. Coast from cape Reykjanes to Stigahlid, 1897	1 0
Sailing directions for the West coasts of France, Spain, and Portugal, from Ushant to Gibraltar strait, also the African coast from cape Spartel to Mogador, 6th edition, 1900	4 0
Mediterranean Pilot, vol. 1. Comprising Gibraltar strait, coast of Spain, African coast from cape Spartel to gulf of Gabes, together with the Balearic, Sardinian, Sicilian, and Maltese islands, 3rd edition, 1894	5 0
Supplement, 1898	0 4
——— 2. Comprising coast of France and of Italy to the Adriatic; African coast from Jerbah to El Arish; coasts of Karamania and Syria. Together with the Tuscan archipelago, and islands of Corsica and Cyprus, 3rd edition, 1895	5 0
Supplement, 1898	0 4
——— 3. Comprising the Adriatic sea, Ionian islands, the coasts of Albania and Greece to cape Malea, with Cerigo islands; including the gulfs of Patras and Corinth, 3rd edition, 1899	4 0
——— 4. Comprising the Archipelago, with the adjacent coasts of Greece and Turkey; including also the island of Candia or Crete, 3rd edition, 1900. (*In progress.*)	
Sailing directions for the Dardanelles, sea of Marmara, Bosphorus, and Black sea, 5th edition, 1900	3 6
North America and West Indies.	
Newfoundland and Labrador Pilot. Comprising also the strait of Belle-isle, the North-east and part of the North coasts of Labrador, 3rd edition, 1897	6 6
Supplement, 1899	1 0
Sailing directions for the South-east coast of Nova Scotia and bay of Fundy, 4th edition, 1894	4 0
Supplement, 1900	0 6
St. Lawrence Pilot, vol. 1. Containing sailing directions for the gulf and river St. Lawrence, 6th edition, 1894	3 6
Supplement, 1901. (*In progress.*)	

* Will be superseded by Arctic Pilot, Vol. 2.

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Title.	*Price.* s.	d.
NORTH AMERICA AND WEST INDIES—*cont.*		
St. Lawrence Pilot, vol. 2. Containing sailing directions for the southern parts of the gulf of St. Lawrence, and for its South entrance through Chedabucto bay and the gut of Canso, 6th edition, 1895 -	3	6
Sailing directions for the East coast of the United States of America, from the bay of Fundy to cape Canaveral, 1st edition, 1899 - - - - - - - -	3	6
West India Pilot, vol. 1. From cape Orange in Brazil to cape Sable in Florida, with the adjacent islands, 5th edition, 1893 - -	3	0
Hydrographic Notice, No. 2 of 1896 -	1	0
——— 2. The Caribbean sea, from Barbados to Cuba, with Florida strait, Bahama, and Bermuda islands, 5th edition, 1899 - - - - - -	6	0
SOUTH AMERICA AND PACIFIC OCEAN.		
South America Pilot, part 1. East coast of South America, from cape St. Roque to cape Virgins, with the Falkland, South Georgia, Sandwich, and South Shetland islands ; also the North coast from cape St. Roque to cape Orange, in French Guiana, 5th edition, 1901. (*In progress.*)		
——— 2. Comprising Magellan strait, Tierra del Fuego, and West coast of South America from cape Virgins to Panama bay, also the Galápagos islands, 9th edition, 1895 - - - - - -	7	6
Supplement, 1898 - - - -	0	6
Sailing directions for the West coasts of Central America and the United States from the bay of Panama to Juan de Fuca strait, 1st edition, 1896 - - - - - -	3	0
British Columbia Pilot. Coast of British Columbia from Juan de Fuca strait to Portland canal, together with Vancouver and Queen Charlotte islands, 2nd edition, 1898 - - -	5	6
Supplement, 1898 - - - - - - - -	0	6
Sailing directions for Bering sea and Alaska, 1st edition, 1898 -	4	0
AFRICA.		
Africa Pilot, part 1. From cape Spartel to the river Cameroon, including the Azores, Madeira, Canary, and cape Verde islands, 6th edition, 1900 -	4	0
——— 2. From the river Cameroon to the cape of Good Hope, including Ascension, St. Helena, Tristan da Cunha, and Gough islands, 5th edition, 1901. (*In progress.*)		
——— 3. South and East coasts of Africa from the cape of Good Hope to cape Guardafui, also islands in the main route through Mozambique channel, 6th edition, 1897 -	4	0
Supplement, 1900 - - - -	0	8

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Title.	*Price.* s.	d.
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Red Sea and Gulf of Aden Pilot. Containing description of the Suez canal, the gulfs of Suez and Akabah, the Red sea and strait of Báb-el-Mandeb, the gulf of Aden with Sokótra and adjacent islands, and part of the Eastern coast of Arabia, 5th edition, 1900	3	6
Persian Gulf Pilot. The gulf of Omán, and the Makran coast, 4th edition, 1898	4	0
West coast of Hindustan Pilot, including the gulf of Manár, the Maldive and Lakadive islands, 4th edition, 1899	4	0
Bay of Bengal Pilot. Containing sailing directions for the bay of Bengal, and the adjacent coasts of Hindustan, Burma, and Siam, together with Ceylon, the Nicobar, and Andaman islands, and the North coast of Sumatra, 3rd edition, 1901. (*In progress.*)		
Islands in the Southern Indian ocean westward of longitude 80° E., including Madagascar, 1891	5	0
Supplement, 1898	0	9
CHINA SEA, AUSTRALIA, NEW ZEALAND.		
China Sea Directory, vol. 1. Containing approaches to the China sea, by Malacca, Singapore, Sunda, Banka, Gaspar, Carimata, Rhio, Berhala, and Durian straits, 4th edition, 1896	4	0
Supplement, 1899	0	8
——— 2. Directions for the China sea between Singapore and Hong-Kong, 4th edition, 1899	4	0
——— 3. Comprising the coast of China, from Hong-Kong to the Korea; North coast of Luzon, Formosa island and strait; the Babuyan, Bashi, and Meiaco Sima groups; Yellow sea, gulfs of Pechili and Liau-tung. Also the rivers Canton, West, Min, Yung, Yangtse, Yellow, Pei Ho, and Liau Ho, and Pratas island, 3rd edition, 1894	4	6
Supplement, 1898	0	4
——— 4. Comprising the coast of Korea, Russian Tartary, Japan islands, gulfs of Tartary and Amur, and the sea of Okhotsk; also the Meiaco, Liukiu, Linschoten, Mariana, Bonin, Saghalin, and Kuril islands, 3rd edition, 1894	3	6
Supplement, 1898	0	4
Eastern Archipelago, part 1. Comprising the Philippines, Sulu archipelago, North-east coast of Borneo, Celebes sea, North-east coast of Celebes, Molucca and Gillolo passages, Banda and Aráfura seas, North-west and West coasts of New Guinea, and North coast of Australia, 1st edition, 1890	4	6
Revised Supplement, 1898	1	0

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Title.	*Price.* s. d.
CHINA SEA, AUSTRALIA, NEW ZEALAND—*cont.*	
Eastern Archipelago, part 2. Comprising the South-east coast of Sumatra, Java, the islands East of Java, Celebes, and the South and East coasts of Borneo, 1st edition, 1893	5 0
Supplement, 1899	0 8
Australia Directory, vol. 1. South and East coasts, Bass strait, and Tasmania, 9th edition, 1897	5 0
Supplement, 1900	0 6
——— 2. Comprising the East coast from Sydney to Torres strait. Torres strait. Coral sea. Also a part of Carpentaria gulf, 5th edition, 1898	4 0
Supplement, 1900	0 6
——— 3. North, North-west, and West coasts, from the gulf of Carpentaria to cape Leeuwin, with directions for passages through the neighbouring seas, 3rd edition, 1895	4 6
Supplement, 1898	0 6
New Zealand Pilot, including also the Chatham islands, and the off-lying islands southward of New Zealand, 7th edition, 1900. (*In progress.*)	
Pacific Islands, vol. 1 (Western groups). Sailing directions for the South-east, North-east, and North coasts of New Guinea, Louisiade, and Solomon islands, Bismarck archipelago, Caroline and Mariana islands, 3rd edition, 1900	5 0
——— vol. 2. Containing sailing directions for New Caledonia, Loyalty islands, Bank, Torres, and Santa Cruz groups, Fiji islands, Tonga, Samoa, Union, Phœnix, Ellice, Gilbert, and Marshal groups, 3rd edition, 1900	6 0
——— vol. 3. Sailing directions for the Tubuai, Cook, and Society islands; Tuamotu or Low archipelago; Marquesas, Line islands or scattered islands near the equator, and the Sandwich or Hawaiian islands, 3rd edition, 1900	3 0
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DEVIATION OF THE COMPASS, &c.	
Practical rules for ascertaining and applying the deviation of the compass, 1892	0 6
Admiralty manual for ascertaining and applying the deviations of the compass, 6th edition, 1893	3 0
Questions and answers relating to the compass, 1898	0 6

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* *Note.*—The Agents in Tokyo for Japanese charts are the Nippon Yusen Kaisha.

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